Massachusetts Institute of Technology

Departments of:
Urban Studies and Planning
Civil Engineering
Economics
Materials Science and Engineering

In conjunction with the Laboratory of Architecture and Planning

Environmental Impact Assessment Project

Funds for this project provided by the Natural and Environmental Sciences Division of the Rockefeller Foundation

Additional copies of this paper
and other project reports are
available from:

Environmental Impact
Assessment Project
Laboratory of Architecture
and Planning
Room 4-209
Massachusetts Institute
of Technology
Cambridge, Massachusetts
02139

Project Title:

Environmental Impact
Assessment:
Technical and
Institutional Frontiers

Project Director:

Lawrence Susskind
Associate Professor of Urban
Studies and Planning

Project Staff:

Faculty:
Lawrence Bacow
Assistant Professor of
Law and Environmental Policy

Michael Bever
Professor of Materials
Science and Engineering

Philip Herr
Associate Professor of Urban
Studies and Planning

Marvin Manheim
Professor of Civil Engineering

David Marks
Professor of Civil Engineering

Michael O'Hare
Associate Professor of Urban
Studies and Planning

Jerome Rothenberg
Professor of Economics and
Urban Studies

Administrative/Research Staff:
Kathryn Hildebrand
John Pitkin
Debra Sanderson Stinson
Leova Wolf

Student Staff:
Deborah Cohen
Norman Dale
Rebecca Dickenson
Denise DiPasquale
Peter Furth
David Kagan
Gail Kendall
Wendy Landman
Mary Lord
Thomas Lustig
Brian Mellea
Craig Miller
Richard Newcome
Richard Noss
Wayne Raila
Joanne Roche
Judah Rose
Ilan Salomon
Barbara Slotpole
James Spencer
Alan Weinstein
Julie Wondolleck

U.S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER
2234 SOUTH HOBSON AVENUE
CHARLESTON, SC 29405-2413

Evaluating Development Impacts

Philip Herr
Gene Slater
Robert Bluhm

Environmental Impact Assessment Project
Laboratory of Architecture and Planning
Massachusetts Institute of Technology

May 1978

Revised October 1978

CONTENTS

LIST OF TABLES

LIST OF FIGURES

PREFACE

This guidebook was initially prepared under sponsorship of the Massachusetts Department of Community Affairs Office of Local Assistance and the Town of Chelmsford Planning Board. It has been thoroughly rewritten under sponsorship of the Environmental Impact Assessment Project of the M.I.T. Laboratory of Architecture and Planning. This rewriting benefitted from direct observation of the guidebook's use in Chelmsford, from written evaluations collected by D.C.A. from a number of the guidebook's users, from telephone interviews with some of those users, from reviews by a number of faculty and staff members of this Project and others at M.I.T., and from use as a course text, thesis guide, and office manual.

Gene Slater, then of Philip B. Herr & Associates, wrote most of the first draft. Robert Bluhm did most of the second draft revision as a staff member of this Project. Philip Herr supervised both, did a third draft, and probably muddied the waters.

INTRODUCTION

Scope

This book is intended as a practical guide for local governments analyzing impacts of development proposals of community-wide significance. It provides a general approach to impact analysis, suggests methods, points out key issues, and provides background information.

The subject is vast. This guidebook can only deal with some of the important issues. It focusses on:

1. Massachusetts, with methods appropriate for the state's fiscal system, zoning, and land use controls. Massachusetts sources are used where available. However, most of the methods, with slight modifications, will be useful in all states.

2. Small communities, with fewer than 50,000 people.

3. "First-cut" methods for use by laypersons -- local officials and citizens -- to identify major impacts of a proposal, rather than more elaborate and technical approaches; professional analysis is suggested where appropriate.

4. Traffic, public facility, fiscal, economic, social and visual impacts, not impacts on the natural environment, hard-to-predict social/psychological effects (sociability, crime), compliance with local plans, or changes in government operations (police patrol patterns, snow plow routes, etc.) except where they affect the tax rate or require new facilities.

5. Specific development proposals for particular sites, not long-range comprehensive plans for the whole community.

6. External impacts of the development on the rest of the community, rather than internal issues such as traffic circulation within the site.

7. Local impacts of the development, not effects on the region or the state; the regional planning agency, Office of State Planning, and Department of Community Affairs (Massachusetts) can help evaluate broader impacts of development.

7. Local procedures and regulations to provide a framework for impact analyses.

How to Use This Book

This guidebook covers a wide range of issues and possible situations. It is designed more for reference than for reading cover to cover. Organization is as follows:

a. The first chapter describes an overall approach to prepare for, conduct, and interpret findings of impact studies.

It is strongly recommended that this chapter be read first regardless of what specific impacts are being considered. It contains important information not repeated elsewhere in the guidebook, establishes a vocabulary for impact analysis, outlines central concepts of impact prediction and comparision, and highlights specific ways to use impact findings in local land use decision making.

b. The next six chapters are "How To Do It" chapters that deal with particular issues: e.g., fiscal impacts, traffic impacts. Only some of the sections will be relevant for any particular proposal.

c. Chapter 8 discusses pulling all of the impact predictions together and using that in decision-making.

CHAPTER 1
PROCESS OF IMPACT ANALYSIS

Why Impact Analysis?

Communities are often confronted with major development proposals whose effects are large, mixed, unclear, and perhaps hotly disputed. They may assume community-wide significance for several reasons.

- They may be unusually large: major subdivisions, multi-family housing, shopping centers, or industrial parks.

- Whether large or small, they may be precedent setting, such as the first subdivision in farmland or forest areas of town.

- They may represent important deviations from the community's planning for growth.

- They may exceed the capacity of a public facility which must service them.

- The proposed site may be a critical area, such as a visually prominent bluff, a location near a town's major gateway, near a landmark, or for other reasons symbolically significant to the community.

A careful and systematic consideration of the consequences of such proposals will help to:

1. Inform local discussion and understanding of the proposal;
2. Bring issues out into the open and deal with them explicitly;
3. Ensure consistency and fairness by applying a systematic procedure from one proposal review to the next;
4. Suggest ways of changing the proposal so that it becomes more responsive to local needs;
5. Provide information for and help justify the public decision; e.g., a zoning amendment, special permit, variance, subdivision plan approval, or urban renewal project;[1]
6. Identify public facilities and services that may need to be built, extended, or whose operating schedule and procedures may need to be modified;
7. Identify local issues which go beyond the particular development

---

[1]Analysis may also be helpful for local input into a state or federal decision such as the Massachusetts State Housing Appeal Committee's decision on a Ch. 774 low and moderate income housing project.

proposal, suggesting an agenda for community action (e.g., revising zoning requirements, studying certain public facilities in more depth); analysis of a specific and perhaps controversial major development can provide the concreteness and sense of urgency that suggestions in general planning documents such as a Master Plan sometimes lack.

Impact analysis should not be used, however, to delay a proposal to death. Where imposed simply as an extra "hurdle," analysis is unfair to the developer, legally questionable, and often wastes the developer's and community's time, money and energy.[1]

Impact analysis can be most effective when treated as an integral part of the community decision-making process. Timing, contents and method of preparation should all be keyed to that process. Following is a step-by-step discussion of how a community might use impact analysis to aid local decisions.[2]

STEP 1. PREPARE FOR MAJOR DEVELOPMENT PROPOSALS

The following actions can be taken before the community is faced with a major proposal. (Not all are relevant or needed in any one community.)

Amend Regulations to Control Impacts

Many potential development impacts are ordinarily controlled by standards in the zoning bylaw and subdivision regulations, such as those dealing with off-street parking, noise and vibration levels, number of units in each multi-family structure, drainage and erosion. Parking impacts, for example, can often be confined to the site by adequate off-street parking requirements. Wherever clear and generally applicable standards are possible, they provide the fairest, simplest, and most efficient way to control impacts.

Amend Regulations to Allow Better Review

It is often appropriate to require a special permit or other review and approval procedure for developments likely to have major impacts on the com-

---

[1] Extra delays can be avoided in some cases by conducting impact studies as part of special permit or site plan review procedures or at the same time as (and input into) a federally or state imposed environmental assessment procedure.

[2] A valuable book on this subject is Philip Schaenman, Using an Impact Measurement System to Evaluate Land Development, Washington, D.C.: Urban Institute, 1976.

munity, rather than allow them automatically if they are in the right location and category of use. The special permit process enables officials to analyze a specific development proposal, obtain detailed information from the developer, learn the views of interested parties through a public hearing, attach conditions (as suggested by the analysis) and make a discretionary decision based on prestated criteria. Such a process might be required for all developments over some size (e.g., 10,000 sq.ft. floor area), or in certain categories of use (heliports), or in certain locations (steep slopes).

Amend Regulations to Require Impact Data

Site plan review, special permit, and subdivision submisstion requirements can oblige the developer to detail major development impacts and to conduct at least some of the impact analyses (which should be reviewed carefully by other parties).

Such submission requirements should make clear in advance exactly what information and analyses are required. The scope of that information and analysis should be reasonably related to the scale of the proposal, and should focus on information needed for decisions to be made, not just broadly interesting data.

Amend Regulations to Link Approvals to Impacts

Impact criteria can be specified in local zoning as the basis for special permit approval or for density bonuses, as provided in the new Massachusetts Zoning Act. These criteria provide an obvious focus for the analysis. Ways of relating criteria to permit approval include:

a. Individual guidelines, each of which should be satisfied, such as "Shopping Centers should be so located that traffic is not increased 50% or more above current average daily traffic volumes at any location within 1000 feet of the development" and "vehicles egressing from shopping centers shall have at least 400 feet visibility in each travel direction," etc.; or

b. Broad guidelines calling for an overall weighing of negative impacts against positive impacts; for example:

> "Special permits shall be granted by the Special Permit Granting Authority only upon its written determination that the proposed use will not have adverse effects which overbalance its beneficial effects on either the neighborhood or the town, in view of the particular characteristics of the site and of the

proposal in relation to that site. The determination shall indicate consideration of each of the following:

a. Social, economic, or community needs which are served by the proposal;
b. Traffic flow and safety;
c. Adequacy of utilities and other public services;
d. Neighborhood character and social structure;
e. Qualities of the natural environment; and
f. Potential fiscal impact."

Pre-Arrange for Technical Assistance

Major development proposals occur on an irregular basis. It is valuable for the community to have an on-going arrangement to provide capabilities for conducting such analyses. This can avoid last-minute scrambling and enable the experience of each impact analysis to help with the next.

The analyst's role is to structure study efforts, conduct specific studies, obtain and review data from other public agencies and the developer, summarize findings in charts or writing, and report back to and work with the agency responsible for the analysis.

Larger communities generally assign planning department staff to this task. Some small communities retain an outside professional for these contingencies as well as for other technical assistance. A regional planning agency can provide similar services for its member communities.

A non-professional may also serve as the analyst, perhaps a Planning Board member, C.E.T.A. employee, other municipal official or employee, or private citizen who is interested in the subject, willing to invest time and energy, willing to tackle a wide range of issues and deal with numbers, and who is widely regarded as unbiased.

Build Local Data Base

If the community has an extensive, well-organized data base before development proposals are made, it can then conduct analyses quickly and efficiently.

Impact analysis relies heavily on such data as tax rates, levies and assessments; school enrollments; traffic volumes and accident records; water consumption and capacity; building permits; capital improvement plans; housing and population data; studies of existing developments in the community.

Where such data does not exist or is hard to obtain, impact analyses become time-consuming or superficial.

This data base can be assembled and expanded by major all-at-once efforts such as preparing master plans and/or regularly keeping and updating such information (perhaps one duty of a local person who conducts impact analyses).

Define Community Objectives, Prepare Impact Checklist

Development should be evaluated in terms of local concerns and objectives. It is important to spell these objectives out in advance in order that proposals can be initially designed to reflect local concerns, and in order to give better assurance of fairness and consistency in decisions. The objectives should be expressed in terms useful to developers. Local objectives can be documented in a variety of ways, such as by formulating:

-- a formal community growth policy or master plan;
-- local response to the 1976 Massachusetts State Growth Policy Questionnaire issued by the Office of State Planning;
-- specific criteria for the public decision (special permit, site plan review);
-- a checklist against which to review development proposals; a sample checklist is shown on page 19, but must be adjusted to reflect local concerns.

STEP 2. SCREEN PROPOSALS

Development proposals are presented to a public agency, which must then decide how to review each. Some deserve detailed study. Others, usually the vast majority, do not. The following approach can be used to sort out proposals and determine an appropriate review process for each.

Informal Review by Agency

Officials can quickly screen all proposals, selecting out for further review those proposals which seem important or of uncertain merit or controversial because of, for example, their size, their precedent-setting nature, or the sensitivity of their sites.

Formal Review by Agency, Using Checklist

Those selected proposals can then be screened more formally with a com-

prehensive checklist (such as the one on page 19). Look for potentially significant impacts and guess whether each will be good or bad (value judgements are built into some items: job opportunities presumably are good, traffic hazards bad).

Proposals can then be sorted into two groups:

a. Those not needing further study because their significant impacts are easy to predict, or are almost all good or all bad, or are very limited in number; for such proposals, the filled-in checklist may itself be a useful aid in the public decision.

b. Those needing further analysis to clarify critical impacts or the balance among them.

Decide Scope of Citizen Participation

The public agency should decide how to engage citizen participation in the impact analysis process. It is often valuable to hear from local residents early in the analysis process. They can help identify the issues that deserve the most attention before large amounts of time and energy are invested. Too often, the final public hearing reveals that the issues studied in the most detail were not the ones people were really concerned about.

Participation can be relatively brief or extensive. Possible formats include:

a. Informal hearings. An informal public meeting could be scheduled to hear from neighbors of the proposed development and others who are interested. After the studies are conducted, preliminary findings should be presented to another public meeting, to allow input into the final conclusions.

b. Citizen panels to guide studies. More extensive participation may be valuable where the development is very large and controversial. An underlying issue in such cases is often public distrust of the developer and, sometimes, of local officials. An ordinary technical analysis prepared by a small set of public officials (whether or not helped by outside technicians) is then likely to be seen as biased or only marginally relevant to the controversy.

Citizen panels can be established to guide the studies, providing input and review at each state in the analysis. Such a process can help build public understanding and trust. The resulting analysis is likely to be much more sensitive to local concerns, focused on critical issues, and respected

in the community than one prepared by technicians without such involvement.

Structuring and carrying out such a participatory program requires time (probably two to three months), careful design, and substantial technical input. Organization has to be arranged so that results are not biased (or viewed as being biased) by self-selection of participants. A basic problem is how to recruit and retain participants whose self-interests aren't importantly involved. One way is to make the process itself engaging through game-like techniques, another to reward participants with publicity or even money. Participants need an adequate opportunity to develop understanding of the proposal being considered. They need an opportunity for dialogue, preferably first with people having similar interests, later with people having different ones. Their process should be documented at each step of the way. Finally, again, all this needs to be made engaging and rewarding, or all but the most committed (biased?) will drop out.[1]

STEP 3. STRUCTURE STUDY EFFORT

The next step is to give a clear structure to the study effort. This involves:

-- defining alternative choices to be analyzed;
-- for each alternative, listing the possible resulting outcomes;
-- defining the comparison system;
-- choosing the issues that deserve detailed attention;
-- choosing who will give them that attention.

This initial structuring (called "scoping" by E.O.E.A. in administering the Massachusetts impact law) is crucial to the usefulness of the study results. Selecting the wrong alternatives to analyze, studying the wrong issues, or using inappropriate spatial or temporal boundaries fatally flaw more impact analyses than do inaccurate predictions: no amount of predictive and evaluative effort can make an ill-framed study useful.

Define the Alternatives to be Analyzed

Public decisions, especially those regarding private land development, often permit a wide range of possible outcomes. Rezoning for commerce

[1] See Lawrence Halprin and Jim Burns, Taking Part: A Workshop Approach to Collective Creativity, Cambridge, Mass.: MIT Press, 1974, for innovative approaches to engaging participation.

doesn't assure new retailing: maybe that same rezoning allows apartments, and that is what the town gets, not the retailing the developer illustrated in seeking rezoning. "Retailing" isn't a public decision alternative, but "commercial rezoning" is, and has retailing as one possible outcome, along with apartments, vacant land, and others. Because public land management decisions seldom have determinate outcomes, it is essential that impact analysis be focused on the decision choices and their full range of possible outcomes, and not just on select outcomes. In most cases, that isn't the same as analyzing what the developer may describe as his intended development, since:

a. The developer may not actually be able to carry out his intent because of unforseen market, financing, or other contingencies.
b. The developer may not even intend carrying out the proposal he illustrates. Rezoning almost never carries a commitment to a specific scheme, and even special permits often allow a wide range of alternatives under them.
c. Some part of what is proposed might not be affected by the present decision, perhaps because that part already has all necessary approvals, or is located in another jurisdiction.
d. The real issue may be larger than the submitted proposal. Approval of a project might be, for example, precedent-setting. Approval of a large development might stimulate additional development of the same kind. The proposal might be situated on only a small piece of a larger area whose entire rezoning is being decided upon.

Accordingly it is necessary to carefully define exactly what is to be analyzed. In some cases, it will be the developer's proposal or some modification of it. In other cases, it will be the range of expectable outcomes possible under the requested approval.

Define Outcomes

Each alternative decision will have one or more possible outcomes. Rezoning a hypothetical site to allow apartments might result in:

a. Immediate apartment development (the usual presumption).
b. Apartment development after a long wait for market and financing to be favorable.

c. Single family development (sometimes higher-density single-family development is allowed by the same rezoning which allows apartments, and might be more attractive to the developer under altered market conditions).

d. No development for several decades, despite rezoning.

Deciding not to rezone the site might result in:

a. No development for several decades (the usual presumption for analysis).

b. Single family development at relatively low density right away.

c. Apartment development after a long wait, authorized by a later political circumstance.

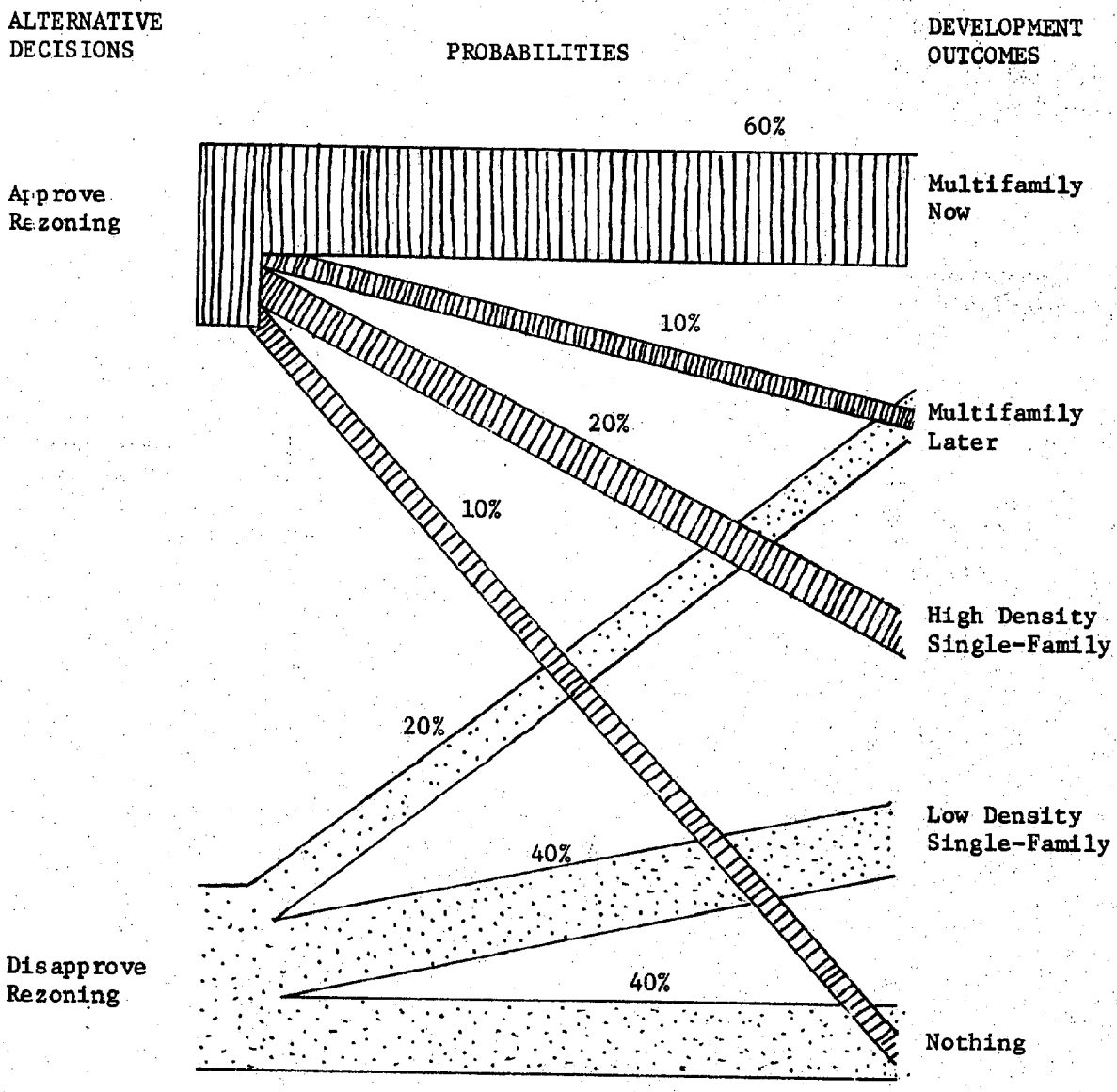
Thus the two decision alternatives have five distinct possible outcomes (actually there are more, but of low enough likelihood to be safely ignored). The possible outcomes following from each decision are much the same; the most important difference between the alternative decisions is the relative likelihood of each of the outcomes (Figure 1-1).

	Judged likelihood of outcomes if the town			
	Approves rezoning		Disapproves rezoning	
Immediate apartments	High	(60%)	None	(0%)
Later apartments	Slight	(10%)	Fair	(20%)
High-density single family housing	Fair	(20%)	None	(0%)
Lower-density single family housing	None	(0%)	Strong	(40%)
No development for decades	Slight	(10%)	Strong	(40%)
Some of the above		(100%)		(100%)

These outcomes are the specific subject of impact analysis. With abundant time and resources, all five outcomes would be analyzed. With limited resources, perhaps only immediate apartments, lower density single-family, and no development would be analyzed.

Regrettably, there is another complication. The apartments, if not built on this site, may be built elsewhere within the town, or they may be substituted for by two-family houses by various builders on scattered sites.

FIGURE 1-1
ALTERNATIVE DECISIONS: OUTCOMES AND PROBABILITIES



In the final assessing of the merits of decision alternatives, those substitution effects also need to be considered. If of high enough likelihood, one or more of them may deserve full impact analysis.

Define the Comparison System

a. What is the geographic scope of the analysis? In comparing alternatives, use of a consistent geographic scope is important. Using a consistent scope will help ensure that a consistent set of interests is reflected in each alternative analysis. Normally, scope should be that of the decision unit: townwide if the decision is a town decision, river-basinwide if it is a basin organization decision, etc.

Impacts may very well spill over the boundaries of the area that has been defined for the purposes of impact analysis. Alternative townwide decisions may be examined by comparing their impacts within the geographic scope of the town; yet, the decisions may have significant impacts on neighboring municipalities or the region. The important matter is that the scope be made explicit so one can be aware of what areas are being included or excluded in the comparison of alternatives. Other agencies, such as the regional planning agency, Office of State Planning, and the Department of Community Affairs, can then be enlisted to help evaluate such broader impacts.

b. What is the baseline against which the impacts of alternative decisions will be measured? The baseline must be explicit and must be consistent from one comparison to the next.

c. What is the time horizon of the outcomes of each alternative decision? It is important to people (as well as to budgets and public facility plans) whether impacts are expected in five years or in twenty years.

We are interested in evaluating what difference accepting or rejecting a proposal makes for any given impact. Therefore, it is important to specify a common time horizon from which to measure change. For example, it is not valid to compare the impact of a project in ten years with current conditions; compare it with a ten year projection of the status quo (which is unlikely to be similar to the current state).

How long will predicted impacts last? For example, tax benefits may not last if service costs increase or if a lowered tax rate induces rapid growth. A modest increase in traffic congestion may relieve itself as motorists respond by redistributing themselves on less congested routes.

Selection of the horizon can be crucial. Many comparisons of alternatives may reverse outcomes at different points in time. Perhaps several horizons need to be analyzed.[1]

Choose Issues that Deserve Detailed Attention

Not all issues can or should be studied in detail. Study effort should focus on those issues where analysis would be most helpful, including those which meet all the following standards:

a. relevant to the public decision; for example, fiscal impacts are appropriately considered when rezoning, but not when reviewing a subdivision plan, since that isn't a legally proper consideration under Massachusetts law for plan disapproval or modification;

b. can and need to be clarified by technical analysis; some impacts may already be clear, others so elusive that potential analysis would not be very useful;

c. of particular local concern; e.g., development impacts on water or schools where a new system or significant expansion may be needed; and

d. are likely to be significantly affected by the development proposal (significant impacts may already have been quickly identified when going through the checklist to screen the proposal).

Sources for identifying significant impacts include:

- Residents' concerns emerging from participatory efforts;
- Local experience of similar developments including the concerns they raised and their actual impacts;
- The discussion in this guidebook of key development attributes which affect each type of impact;
- Analogy with the experience of other communities which have had a similar development; if a million-square-foot shopping center is proposed, it might be revealing to contact a town having one, to find out what unanticipated impacts occurred there.

---

[1] For those comfortable with them, there are more sophisticated quantitative approaches for dealing with uncertainty and timing of consequences, such as decision theory and present value analysis. See, for example, Howard Raiffa, Decision Analysis: Introductory Lectures on Choices Under Uncertainty, Reading, Mass.: Addison-Wesley, 1968; James Van Horne, Financial Management and Policy, Englewood Cliffs, N.J.: Prentice-Hall, 1974. Such non-intuitive approaches may, however, discourage many citizens from trying to understand the analysis.

Issues should be framed as specifically as possible, in order to focus study effort. For example, the sample checklist breaks "traffic" down into more specific issues of peak hour congestion, safety hazards, and street character. Especially where there is controversy, it is useful to agree on what issues are being debated.

Choose Who Will Study Each Issue

Indicate who will study each issue, in order to allocate budget and responsibilities and to get the effort underway.

Studies may be provided and paid for by the community, by the developer, or by both together. It is generally valuable for a single person (or organization) to be in charge of the overall effort, but particular issues may be assigned to a public agency (e.g., school department, conservation commission), the developer's architects and engineers, or other specialists.

STEP 4. PREDICT IMPACTS

Key Questions

Analysis should address the following questions:

a. For each impact category that has been selected for study, what are the results for each of the outcomes being considered? It is generally useful to:

- -- indicate all significant impacts (including obvious ones), not just those studied in detail;
- -- where impacts are still unclear or unknown, that too should be indicated (in table format, a simple "?" is quite eloquent);
- -- show how large each impact would be (in table format, simple orders of magnitude [is it closest to 10, 100, or 1000] are often best).

b. Will any significant secondary impacts arise under each outcome? New development can stimulate further development and/or immigration with impacts on traffic, taxes, etc.

c. Who will be most affected? Elderly may benefit differently from teenagers, workers from businessmen, renters from owners, potential newcomers from long-time residents. Many proposals are economically and fiscally good for the community as a whole, but impose traffic and aesthetic burdens on the surrounding neighborhood. Effects on different groups in the community (often called "distributional impacts") should be noted.

Methods

The level of detail appropriate for analysis will vary from one issue to another, depending on its importance, the available data, and the skills of the analyst. For example, fairly precise predictions may be needed to choose the "right number" of dwelling units in a development. But to decide whether or not to have a factory, one may require only crude results to locate the decision safely in the "yes" or "no" zone. It should be kept in mind that the precision of the analysis os often limited by unreducible uncertainty of a key element, making great precision in other parts of the analysis irrelevant. For example, if the percentage of dwelling units to be seasonally occupied is utterly unpredictable, refining the predicted number of school children per year-round dwelling to two decimal places is a waste of energy.

Specific study methods are outlined in later chapters. In general, studies should be based on:

-- quantification where reasonable; approximate numbers and rough estimates are often all that is needed or useful;
-- thinking through and stating other qualitative impacts; issues should not be ignored because they are hard to quantify.

Indicate Uncertainties

The uncertainty of the predictions should be clearly stated. Impact analyses rely on past studies of other developments, assumptions about future change in the community and often crude methods for allocating impacts among types of development. These uncertainties can at least be reflected by rounding off estimates, putting numbers in a range from low to high, or stating the results qualitatively. More than two figures accuracy (11, not 10.78) is rarely justified.

More fundamental uncertainties should also be stated. Findings may be very sensitive to certain assumptions, such as those about:

-- the probability of development;
-- what form development will take in the long run; later changes in a preliminary scheme might make impacts much better or worse;
-- the expected demand of new development, e.g., water use, number of school children, amount of traffic (general standards may not fit the particular development for one reason or another);

-- the state's fiscal system, since changes might reduce local fiscal consequences of development.

Indicate where alternative, but still reasonable, assumptions would give very different results.

STEP 5. EVALUATE IMPACTS

Predicting how much traffic or taxes or social change a development will generate is quite different from evaluating those impacts: assessing how good or bad each impact is in relation to the others, so as to reach summary conclusions regarding the advisability of one decision alternative versus another. For any individual or interest group there is the question of how impacts trade-off against one another: how much traffic increase counterbalances a given gain in neighborhood recreation space? For the decision-making body, a further difficulty is the balancing of the interests of different groups: how much tax benefit citywide counterbalances a given traffic increase impacing this particular neighborhood?

Techniques for structuring such evaluations are discussed in Chapter 8.

STEP 6. USE FINDINGS IN DECISION

The major reason for making the impact analysis is in order to provide information to those making a decision. Getting the findings reflected in the decision requires linking the analysis and decision-making processes, and finding ways of assuring that the actions which follow the decision really conform with all of its stipulations, easy when it is public building which is involved, but sometimes hard when private development is involved. Again, this is discussed in Chapter 8.

SUMMARY

Step 1. Prepare for Major Development Proposals

- Amend regulations.
- Pre-arrange for technical assistance.
- Build local data base.
- Prepare impact checklist.

Step 2. Screen Proposals

- Agency review.
- Citizen participation.

Step 3. Structure Study Effort

- Define the alternative decisions.
- Define the outcomes of each alternative and estimate their relative likelihoods.
- Define the comparison system.
  - -- Specify a consistent geographic scope for comparing impacts of different outcomes.
  - -- Establish a consistent baseline from which to measure change.
  - -- Establish a consistent time horizon.
- Select issues deserving detailed attention.
- Choose who will study each issue.

Step 4. Predict Impacts

- Round off estimates; give ranges where possible.
- Measure impacts on different groups (if significant).
- Consider secondary impacts.

Step 5. Evaluate Impacts

- Are impacts of one alternative better or worse than impacts of another alternative?
- What population groups will gain or lose (if any)?
- Highlight key choices.

Step 6. Use Findings in Decision

TABLE 1-1
(SAMPLE) IMPACT CHECKLIST

Impact on	Impact likely to be: Not Significant	Significant Good	Significant Bad	Don't Know	Deserves further study by	For method see page
Traffic						
Congestion at peak hour	___	___	___	___	_____	22, 38
Safety hazards	___	___	___	___	_____	34
Quality of life on nearby streets	___	___	___	___	_____	40
Public Facilities						
Need for major school additions or construction	___	___	___	___	_____	48
Need for major improvements in public water system	___	___	___	___	_____	51
Need for major improvements in public sewer system	___	___	___	___	_____	56
Need for major improvements in public recreation facilities	___	___	___	___	_____	50
Need for major improvements in other public facilities: (specifiy)						
_____	___	___	___	___	_____	
_____	___	___	___	___	_____	
_____	___	___	___	___	_____	
Municipal Finances						
Local tax rate	___	___	___	___	_____	63
Bonded indebtedness	___	___	___	___	_____	82
Economy						
Increase in job opportunities	___	___	___	___	_____	91
Type of job opportunities	___	___	___	___	_____	95
Sales level of existing businesses	___	___	___	___	_____	99
Entrepreneurial opportunities	___	___	___	___	_____	101

TABLE 1-1 (continued)

Impact on	Impact likely to be: Not Significant	Significant Good	Significant Bad	Don't Know	Deserves further study by	For method see page
Economy (continued)						
Diversity of the local economy, other long term effects	___	___	___	___	_____	101
Nearby property values	___	___	___	___	_____	102
Social Character						
Community population, total and growth rate	___	___	___	___	_____	112
Local housing supply, range of choice, esp. for low and moderate income residents	___	___	___	___	_____	119
Local government structure, style	___	___	___	___	_____	123
Community amenities, e.g., range of shops, facilities; historic sitees	___	___	___	___	_____	123
Visual Character of Area						
Image of community held by residents and outsiders	___	___	___	___	_____	126
Other Municipalities						
Spillovers on neighboring communities	___	___	___	___	_____	a
Spillovers on region or state	___	___	___	___	_____	a
Community Growth and Planning						
Departure from Master Plan or community growth policy	___	___	___	___	_____	a
Site valuable for (or well-suited to) other kinds of development	___	___	___	___	_____	a
Precedents for future public decisions	___	___	___	___	_____	a

TABLE 1-1 (continued)

Impact on	Impact likely to be: Not Significant	Significant Good	Significant Bad	Don't Know	Deserves further study by	For method see page
Community Growth and Planning (continued)						
Spatial pattern of growth in the community	___	___	___	___	_____	a
Stimulus to further development	___	___	___	___	_____	a
Natural Environment						
Level of air pollutants	___	___	___	___	_____	a,b
Groundwater and surface water quality (e.g., "highest safe use")	___	___	___	___	_____	a,b
Noise and vibration level in vicinity	___	___	___	___	_____	a,b
Erosion on and off-site	___	___	___	___	_____	a,b
Risk and damage of natural disaster (e.g., building on a floof plain)	___	___	___	___	_____	a,b
Ecological stability of fragile areas (such as dunes and wetlands)	___	___	___	___	_____	a,b
Groundwater level	___	___	___	___	_____	a,b
Wildlife habitats	___	___	___	___	_____	a,b
Natural vegetation, esp. unusual species and mature trees	___	___	___	___	_____	a,b

[a]Not dealt with in this guidebook

[b]See bibliography for some sources

CHAPTER 2

TRAFFIC IMPACTS

Traffic analysis can be conducted at several levels of detail. Lay officials and citizens can make rough estimates of the traffic impacts of a proposal, or professional traffic engineers can be asked to provide a more thorough, elaborate and precise analysis.

This chapter outlines a set of quick methods and background information for non-professionals. These may be useful for determining possible impacts, for deciding whether a professional analysis is needed, and for reviewing a professional analysis.

In addition, in some cases a community might require developers to submit professional traffic analyses as part of special permit applications. In this way the community could shift the burden of analysis to those proposing major traffic generators.

Whether traffic analyses are conducted by laymen or professionals, they should generally focus on the following questions:[1]

a. To what extent will traffic hazards increase on nearby streets? This is often the most urgent and serious concern about new development.

b. To what extent will there by congestion on nearby streets?

c. How will added traffic affect the quality of life on nearby streets, whether or not there are major safety or congestion problems?

In addition, the analysis should identify possible actions by the developer or the community that would make the above impacts less serious. This might suggest conditions for approving the proposal (e.g., shift the entrance, reduce the size of the development) and indicate the extent of related public street improvements.

AMOUNT OF TRAFFIC

Before analyzing specific impacts on safety, congestion, and the quality of life on nearby streets, one must conduct a preliminary analysis. One must estimate to what degree alternative development outcomes will increase vehicle

[1] Parking impacts are not treated here. It is assumed that off-street parking standards for different uses are contained in a community's zoning by-law and that such regulation can adequately control impact.

trips. First, how much will average daily traffic at critical locations increase? This data will be useful in assessing the traffic impact on safety and quality of life. Second, how much will peak hour traffic increase at critical locations? This will be essential for evaluating impact on congestion. The following steps are involved.

1. AVERAGE DAILY TRAFFIC ANALYSIS

1.1 Determine Current Traffic

The local DPW, Highway Department, or Police Department may have traffic count data. Many towns have recent data collected for the TOPICS program of highway improvements. You can conduct a traffic count if no recent count is available,[1] or just guess. Use of Table 2-1 should enable a guess that will at least be "in the ballpark," and that is often good enough.

1.2 Estimate Offsite Daily Traffic Increase

Estimate future traffic increase on nearby streets that is expected anyway in the absence of any on-site development. Other new development may be built along the road in the next few years. Its potential traffic should be estimated (using methods of steps 1.3 and 1.4) in order to get a realistic picture of long-term traffic on the road.[2] There may also be gradual

---

[1] A 24-hour counter may be used. On residential streets, simply count traffic during the evening rush hour (usually about 4:30-5:30 pm) and multiply by 10 to get a rough estimate of daily traffic. (Incidentally, an evening rush hour count will also be useful for Step 8.)

[2] It may be hard to predict whether (and when) large vacant areas near the proposal will be developed. The traffic estimate should be adjusted to reflect the fact that development may not occur for many years. One can do this by (1) estimating potential traffic from the area (if fully developed), and (2) multiplying this by the probability of development occuring within a certain number of years (say 5 or 10). For example, say there are 500 acres of vacant land served by a critical street. There seems about a 40% chance that all the land will be developed with single-family homes within the next 5 years. Expected traffic can be estimated as follows:

500	acres of vacant land served
x 2	# of dwelling units per acre (current zoning)
1,000	possible # of dwelling units
x 8.5	trips per dwelling unit (Table 2-2)
8,500	possible total trips from vacant land
x .50	proportion using North Street
4,250	possible trips using North Street
x .40	probability of full development within 5 years
1,700	expected trips from now-vacant land near proposal in 5 years

TABLE 2-1
COMMON TRAFFIC VOLUMES

Type of Road	Average Daily Traffic
Community Streets	
Lane or dead-end street	75 - 350
Local street serving abutting property	100 - 1,000
Collector street serving local streets	800 - 3,000
Arterial street distributing traffic throughout communities of 5,000+ population (often the main shopping street:	
Minor (connects neighborhoods or entire small communities)	3,000 - 7,000
Major	7,000 - 30,000[a]
State and Federal Highways	
Secondary highways, relatively short, connecting centers of up to 15,000 population each (e.g., Routes 6A, 32, 63, 119)	1,000 - 8,000
Primary Highways (e.g., US 20, US 5, US 44, Rte. 9, Rte. 140)	5,000 - 35,000[a]
Limited Access Highways (e.g., I-91, I-93, Rte. 3, Rte. 128)	20,000 - 120,000[a]

[a]Higher part of range usually occurs in large metropolitan areas.

Sources: Massachusetts Department of Public Works, "A Statewide Highway Transportation Plan," 1968.
Massachusetts Department of Public Works, "1974 Traffic Volumes."
Urban Land Institute, American Society of Civil Engineers, and National Association of Home Builders, "Residential Streets: Objectives, Principles, and Design Considerations," 1974.

traffic growth on the road from more diffuse sources, such as areawide population and travel increases.

1.3 Estimate Traffic From Development Outcomes

Consider what development is likely to occur under each outcome following alternative decisions. Analyses should be completed for each outcome separately, and then compared.

Estimate the total amount of daily traffic that each development outcome will generate. This is usually measured as the total number of vehicle trips which begin or end on the site on an average day.[1] Estimates can be based on studies of existing developments throughout the country; some results are summarized in Table 2-2.

The following should be kept in mind when using these or other numbers:

a. These numbers are only rough guides. Studies show a wide, and often unexplained, range of results, suggesting caution and skepticism in applying general findings to a particular proposal. In fact, each professional analyst who looks at a proposal will probably come up with a somewhat different traffic estimate, based on his judgement and experience. Where the estimate is far outside the common range in Table 2-2, however, one should ask how the number was estimated. The numbers do not reflect (if any) of the energy crisis on auto ridership.

b. Make sure estimates are comparable. Some studies measure person-trips (not vehicle-trips), peak hour trips (not daily trips), or round trips (not trips each way). One study may show trips per acre of industry, another per employee, and still another per 1,000 square feet of gross floor area.

c. These numbers assume almost all trips are by automobile. If transit and walking would account, say, for half the trips at a new development, simply reduce the Table 2-2 estimate by half.

d. If the outcome involves one use replacing another (e.g., apartments displacing golf course), the traffic formerly generated by the displaced use is subtracted from that of the new use. Occasionally, new development brings less traffic than the use it displaces: the analysis can stop there!

---

[1] These are one-way trips. Each arrival is one trip; each departure is one trip.

TABLE 2-2
AVERAGE DAILY TRAFFIC BY LAND USE

Land Use	Trips per:	Average Daily Traffic (Vehicle Trips Per Day) Average	Common Range
Residential			
Single-family	Dwelling unit	8.5	6 - 14[a,b]
Multi-family	"	6.5	3 - 9[c]
Mobile homes	"	6	4 - 9
Commercial			
Shopping centers			
Regional (500,000+ gsf)	1,000 gsf	40	30 - 50[b]
Community (100,000-500,000 gsf)	"	80	50 - 110[b]
Neighborhood (-100,000 gsf)	"	100	60 - 130[b]
Supermarket	"	130	100 - 150
Discount store	"	40	30 - 55
Drive-in bank	each	1,500	1,000 - 2,000
Gas station	each	400	300 - 700
Other stores	1,000 gsf	50	20 - 120
Fast food restaurants	"	600	400 - 800
Other restaurants	"	150	40 - 300
Hotels, motels with convention facilities	room	9.2	8.5 - 11
Other motels	room	5.6	4 - 7
Industrial			
Manufacturing			
Over 500,000 gsf	employee[d]	2.2[e]	1.9 - 2.7
Less than 500,000 gsf	"	2.9[f]	2.5 - 3.3
Research and development	"	2.4[g]	2.0 - 2.6
Industrial park	"	3.7[h]	2.4 - 4.5
Warehouse	"	4.5[i]	3 - 10
Truck terminal	1,000 gsf	12	10 - 15
Office			
General office	1,000 gsf	11[j]	9 - 17
Medical office	"	53	50 - 80

TABLE 2-2 (continued)

Land Use	Trips per:	Average Daily Traffic (Vehicle Trips Per Day) Average	Common Range
Institutional			
University hospital	bed	37	20 - 17
General hospital	"	14	8 - 22
Long-term care hospital	"	3.5[k]	3 - 5
College[l]	student	2.4	1 - 3
Airport	acre	3.6	2 - 6
Recreation			
Stadium	spectator	1[m]	0.8 - 1.3
Drive-in theatre	parking space	2	1 - 2
Golf course	acre	6	2 - 10
Marina	boat berth	4	2 - 10

gsf = gross square feet building floor area

[a] within range, higher if homes expensive, in outlying areas, and/or with young families and children

[b] New England or East Coast estimates are used, since they are quite different from national averages

[c] within range, higher if large units (2, 3 and 4 bedrooms) and/or in outlying areas; very low if elderly residents

[d] industrial uses can also be estimated per 1,000 gross sq.ft. or per acre, but these are less reliable

[e] average = 4.2 per 1,000 gsf, 32 per acre

[f] average = 4.9 per 1,000 gsf, 22 per acre

[g] average = 5.1 per 1,000 gsf, 73 per acre

[h] average = 9.3 per 1,000 gsf, 76 per acre

[i] average = 5.5 per 1,000 gsf, 73 per acre

[j] Government offices are higher, perhaps twice as high

TABLE 2-2 (continued)

[k] Government offices are higher, perhaps twice as high

[l] for small private planes

[m] assumes full attendance

Sources: Herr Associates estimates based on:

Dennis L. Hansen, Volume XV Travel Generation, National Association of County Engineers Action Guide Series, National Association of Counties Research Foundation, 1972.

Trip Generation by Land Use, Part I: A Summary of Studies Conducted, Maricopa Association of Governments, Arizona, 1974.

Institute of Traffic Engineers, Committee 5N-S, "Guidelines for Driveway Design and Location," Traffic Engineering, February 1973.

Herr Associates, "Performance Zoning II," for Franklin County Planning Department and D.C.A., June 1972.

Institute of Transportation Engineers, Trip Generation, ITE Information Report, 1976.

1.4 Distribute Development Traffic on Nearby Streets

Traffic can't be distributed with any great precision. For each development outcome (and egress point if they use different streets) that is being studied, it is usually easiest to take the site plan and a street map of the surrounding area and think about where people are likely to be travelling (where residents go to work, where the developer's market study expects shoppers to come from, where there are major expressways). Likely routes and number of trips can be plotted on the map up to a certain distance, say a half mile. Not all routes need be thought out to the same distance; those with few trips don't need further consideration. Figure 2-1 shows how trips from a proposed development might be distributed.

We suggest first distributing trips on each street as a percentage of the total (e.g., 20% on North Street, 30% on South Street, etc.). This assures that trips will add up to the total number from the proposal.[1] There are lots of possible complications: one-way streets, added traffic flowing against existing flows, etc. Again, approximations will do.

1.5 Identify Critical Locations

Usually, only a few intersections and stretches of road need further study. These should be quickly identified:

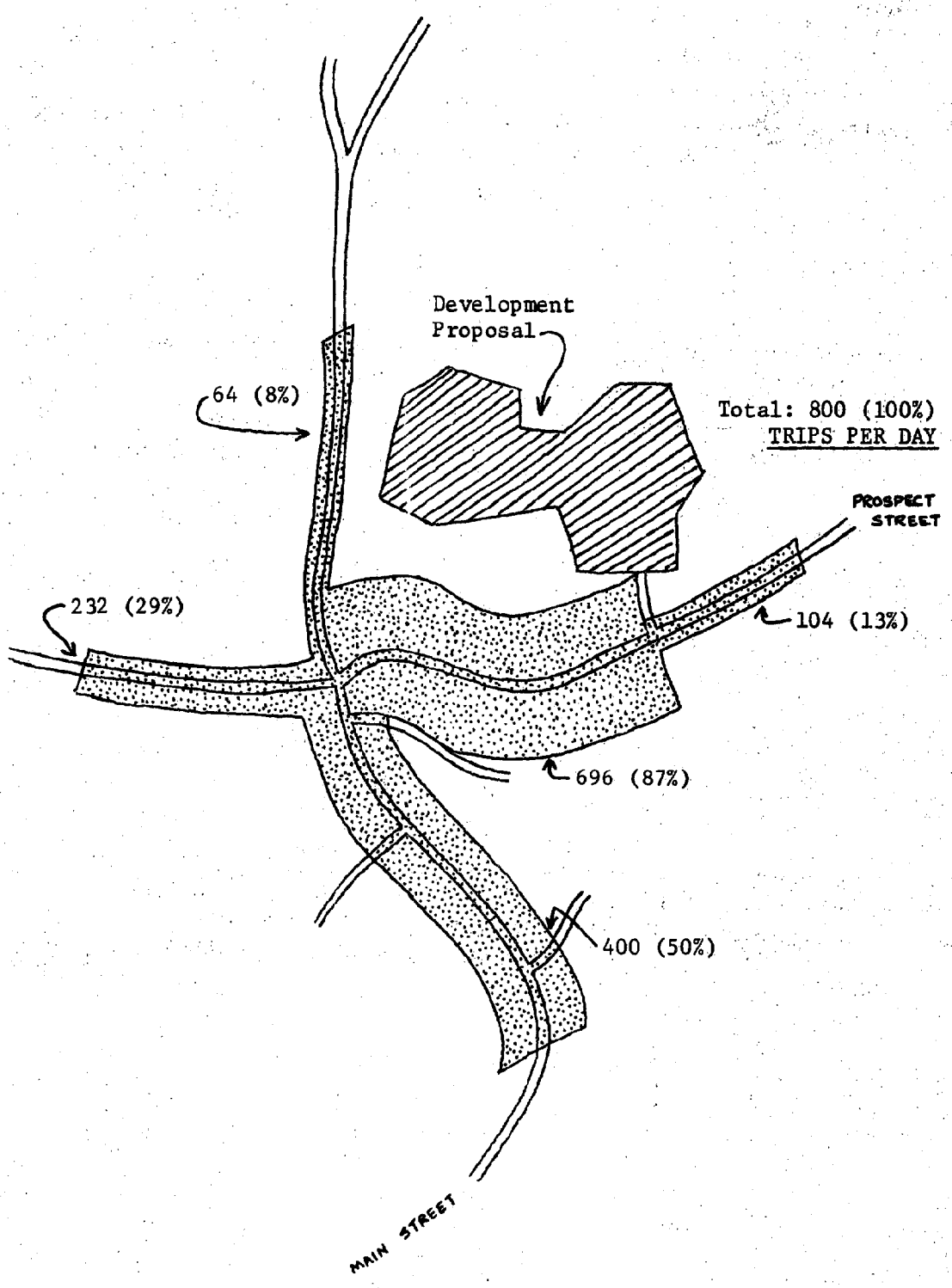
a. Where average daily traffic will increase substantially, say, by more than 25% above current levels. Predicted traffic for each development outcome should be compared with current traffic on each street, either from an available traffic count[2] or a rough guess at traffic on that type of

---

[1] Note: Steps 2 and 3 may exaggerate how many new trips there will be on each street. It is assumed that all outcome traffic is a net addition to nearby streets. In fact, some of the cars stopping at a gas station or a store would have been on the street anyway. We don't know a good way to estimate (or subtract out) such traffic. Assuming all trips are new is probably quite accurate for residences and industries; it is probably least accurate for small stores on major roads. While assuming all trips are new may slightly over-estimate congestion problems, it does indicate safety hazards (e.g., heavy traffic to and from a driveway).

[2] From the local department of public works, a recent TOPICS program in the community, or the Mass. Department of Public Works (which periodically publishes "Traffic Volumes," which gives counts on major roads).

FIGURE 2-1
SAMPLE TRIP DISTRIBUTION FOR A RESIDENTIAL DEVELOPMENT



street. Table 2-1 suggests the range of traffic for different kinds of streets.

b. Where traffic problems already exist. Even a light traffic increase can be serious where frequent backups or accidents already occur. Local police keep accident records and sometimes have a map of them.

1.6 Estimate Percentage Increase in Average Daily Traffic

Compute the percentage increase above current average daily traffic (ADT) for each development outcome:

$$\text{\% Increase in ADT} = \frac{\text{Offsite increase + development traffic}}{\text{Current ADT}} \times 100$$

2. PEAK HOUR ANALYSIS

Next, repeat the above steps for peak hour traffic. This information, together with street capacity data, will be necessary for evaluating congestion impacts.

2.1 Select Peak Hour Location(s) to be Analyzed

Identify places where congestion is likely to be worst, generally where traffic will increase most substantially or where back-ups already occur. If traffic will increase all along a road, congestion will usually be worst at major intersections (where traffic movements cross) or at obstructions (e.g., where the road is narrowest).

2.2 Select Hours to be Analyzed

Decide when congestion is likely to be worst, that is, the peak hour each day. Tables 2-3 and 2-4 can help select the appropriate hour to be analyzed. The peak hour is usually the evening rush hour (about 4:30-5:30 pm) but may be earlier or later if the proposal represents a large share of traffic and has its highest traffic at another hour (Table 2-4).

If traffic is much greater during a certain part of the year (e.g., at a ski area, summer resort, college town), the high-season peak hour is critical and should be analyzed.

NOTE: If the street has more than one travel lane in each direction, it would be best to estimate traffic and go through the following steps for each direction on the street.

TABLE 2-3
EVENING RUSH HOUR TRAFFIC

Type of Land Use	Approximate % of Average Daily Traffic	Approximate % Outbound
Residential	10	35
Commercial	10	50
Colleges, hospitals	10	65
Industrial	18	80
Office	22	80

Source: Herr Associates estimates based on sources in Table 2-2.

TABLE 2-4
UNUSUAL PEAK TRAFFIC TIMING

Land Use	Highest Hour	Approximate % of Average Daily Traffic	Approximate % Outbound
Stadium, drive-in theatre	end of last show	45	almost 100
Regional shopping center	7-8 pm	10-15	45
Major college or hospital	usually morning rush hour	10-15	15
Industrial plant	Depends on shift schedule:		
	beginning of shift	15-35	20
	end of shift	15-35	80

Source: Herr Associates estimates based on sources in Table 2-2; and Louis Keefer and David Witheford, Urban Travel Patterns for Airports, Shopping Centers, and Industrial Plants, Highway Research Board, 1966.

2.3 Estimate Current Peak Hour Traffic

Sources and methods are basically the same as for estimating average daily traffic (Step 1.1). Several approaches are possible:

-- use an available peak hour traffic count;

-- count traffic during the peak hour; or

-- guess, estimating what share of daily traffic occurs during the peak hour (Table 2-3; on most streets, evening rush hour traffic is about 10% of daily traffic).

2.4 Estimate Peak Hour Increase Without Development

-- determine daily traffic from future nearby development and other increases (Step 1.2).

-- estimate what share of that traffic will occur during the peak hour (Tables 2-3 and 2-4).

-- add this to current peak hour traffic.

2.5 Estimate Peak Hour Traffic From Development Outcomes

Multiply traffic generation from each development outcome (Step 1.3 or 1.4) by the percentage of traffic that will occur during the peak hour (Tables 2-3 and 2-4).[1]

2.6 Calculate the % Increase in Peak Hour Traffic

Compute the percentage increase above current peak hour traffic (PHT) for each development outcome.

$$\text{\% Increase in PHT} = \frac{\text{Offsite increase + development traffic}}{\text{Current PHT}} \times 100$$

One can now evaluate specific impacts on safety, congestion, and the quality of life on property along neighboring streets.

---

[1]Direction of traffic can also be easily estimated where necessary. For example, an apartment complex might add 1,000 trips a day to a nearby street. About 10%, or 100 trips, will occur during the evening rush hour. Of these 100 trips, about 35% or 35 trips will be outbound from the development. The rest, about 65 trips, will be heading toward the development.

3. SAFETY

Even if the road initially isn't especially hazardous, modest traffic increases can greatly increase the danger of accidents. Accidents will force drivers and pedestrians to change the way they use the street: children stop playing in the street, pedestrians cross only at corners, drivers slow down; stop signs, traffic signals and street lights may have to be installed. Following are some features to watch out for.

Adequacy of Existing Roads

Where traffic will increase substantially, watch out for the condition and layout of the existing road. The road may be quite safe for current volumes but too narrow, winding, hilly or poorly paved to safely handle traffic from the proposed development. Few streets, for example, have alignments which can handle a 30% traffic increase without becoming hazardous. The following sources may suggest whether the road is adequate for the extra traffic.

a. past accident records, from local police;

b. review by the highway surveyor or superintendent, and local police;

c. where a state road is involved, review by the area office of the State Department of Public Works.

Entrances and Exits

Even if a proposal only increases street traffic slightly, one should pay attention to the location and design of its entrances and exits. Egresses often create hazards, some of which can be easily modified by changing the site plan. Key factors to look out for include:

a. Distance from other driveways and intersections. Where these are very close, turning movements conflict and drivers weave from one lane to another. Problems may occur where the driveway is less than:

-- 250 feet from an intersecting street

-- 250 feet from the driveway of a major traffic generator across the street[1]

---

[1] Unless the other driveway is exactly opposite, simply creating a four-way intersection.

-- 500 feet from the driveway of a major traffic generator on the same side of the street.

b. Number of egresses. Designs which avoid continuous or frequent driveways are likely to be safer than those with such driveways.

c. Slight distances. How far can the driver see to the right and left before he turns onto the street? Table 2-5 shows sight distances suggested by the National Association of County Engineers.[1]

TABLE 2-5
SUGGESTED SIGHT DISTANCES FROM DRIVEWAY

Speed on Street	To Left		To Right
	2-lane street	4- or 6-lane street	
30 mph	350 feet	220 feet	260 ft.
40	530	380	440
50	740	620	700
60	950	950	1,050

Source: Hansen, Travel Generation.

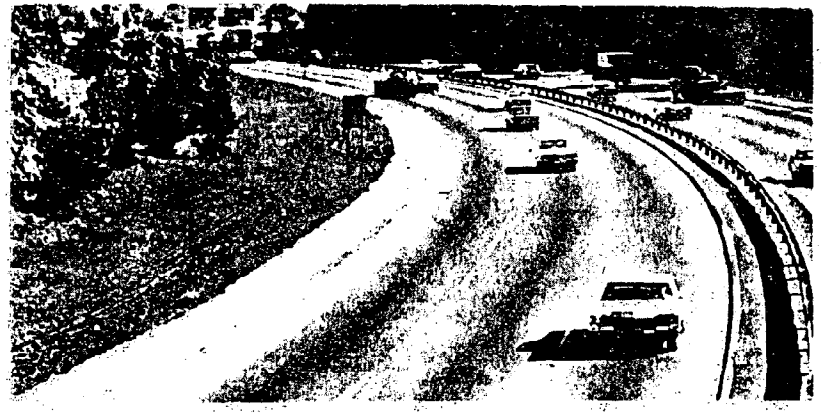
This suggests that egresses should not be near hillcrests, around curves, or near embankments. Less permanent features, such as trees, shrubs, fences and parked vehicles can also block the driver's vision. In some cases it may be appropriate for the developer to grant a sight easement to the community, assuring that underbrush will be kept cleared or that a fence will be removed.

d. Left turn movements. Heavy left turn movements to or from the driveway can be especially dangerous.

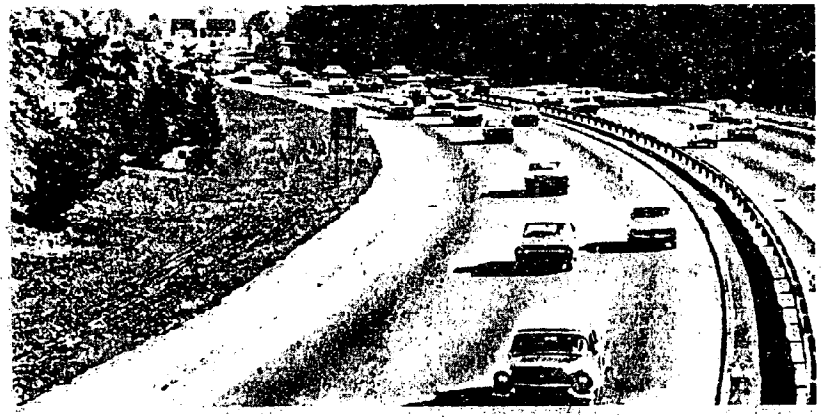
e. Pedestrian flow. The driveway may cross (and conflict with) heavy pedestrian traffic along the street.

[1]Sight distances are measured 10 feet back from the curb; the driver's eye is assumed to be 3.5 feet above the ground, objects are assumed to be 4.5 feet above the ground. Distances should be increased by 10% in rural areas and greatly increased for trucks.

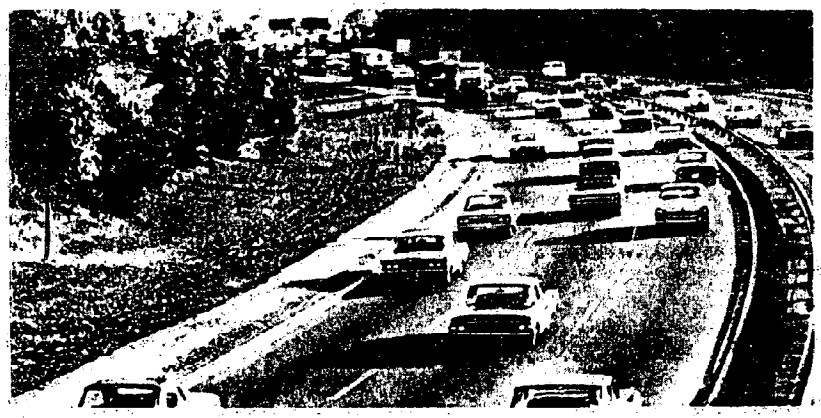
Figure 2-2: LEVEL OF SERVICE



A

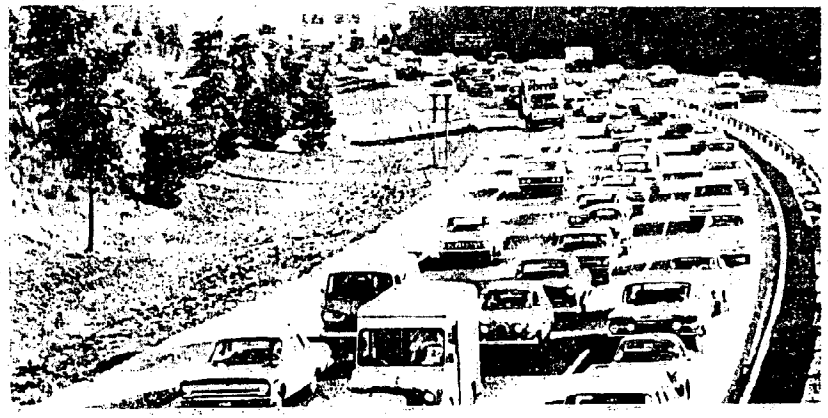


B

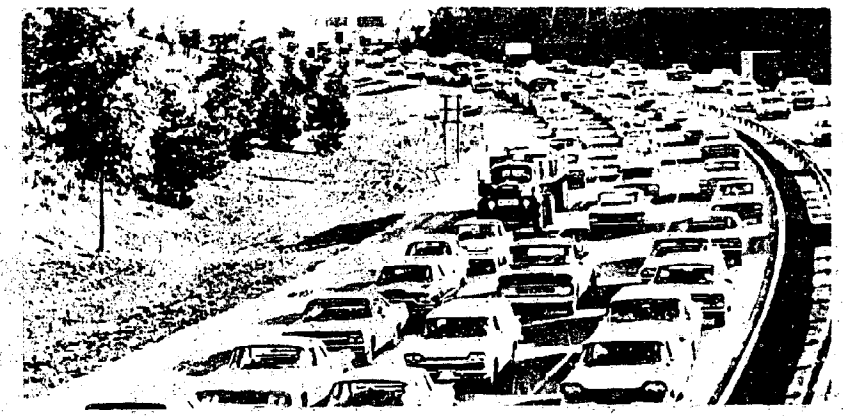


C

D



E



F

Fr : Highway Research Board, Highway Capacity Manual, 1965.

TABLE 2-6
LEVELS OF SERVICE

Level of Service	Description
A	little traffic, no delays or speed reduction due to traffic, relatively free flow
B	slight reduction in speed due to other cars on road
C	satisfactory speeds, reasonably stable flow, speeds and maneuverability restricted by other cars, occasional minor delays
D	occasional serious delays, little space for maneuvering, some cars may have to wait for signal to turn green twice before going through an intersection
E	unstable flow; continuous backups at many intersections creating intolerable delays; hard for traffic to enter from cross streets
F	very low speeds, cars backed up from one intersection to another; jammed

Source: Highway Research Board, Highway Capacity Manual, 1965.

4. CONGESTION

Development traffic can generate (or worsen) traffic jams on nearby streets. Traffic engineers have complex methods for estimating congestion, but a simpler approach can also suggest how congested streets will be.

Congestion depends on the amount of traffic and the "capacity" of the road or intersection. If traffic volumes are large compared to capacity, major delays will occur. Thus far this chapter has predicted how the proposal will increase peak hour traffic; one can now estimate the extent of service deterioration that will result. The following steps are involved.

4.1 Judge the Current Peak Hour "Level of Service"

Table 2-6 and Figure 2-2 describe levels of traffic service which result from the relationship of traffic demand and street capacity. People can usually quickly agree on which level best describes the current situation. The level can also be calculated, but that is complex and, by our observation, subject to a great deal of error even when done by professionals.

If you want a numerical check, the following usually result in level C service:

350-500 vehicles per hour per travel lane at intersections
400-500 vehicles per hour each way on uninterrupted two-lane roads
800-1200 vehicles per hour per lane on interrupted four-lane roads
Up to 1600 vehicles per hour per lane on some expressways

4.2 Estimate the Future Peak Hour Level of Service

If the level of service is now at level B or lower, each 15% increase in peak hour volume (Step 2.6, page 33) will result in approximately one step lower level of service. If service is now at level A, comparison with the volume/service level relationships given in the paragraph above may enable an estimate to be made.

The determination of future levels of service are based on imprecise estimates of trip generation by the development, off-site trip increases, etc. How can one be assured that the determination of future service levels, based on these estimates, are not in error? One approach is to use conservative assumptions. For example, if a drop in service of one level is predicted using "worst case" assumptions, one can then be assured that under all other (laxer) conditions no more than a one step drop in level of

service can be expected. Another approach is to perform the calculations twice, once with low (but reasonable) assumptions and once more with high (but reasonable) assumptions. This will generate a range in results from a range in assumptions, explicitly recognizing uncertainty in the estimates.

4.3 Evaluation

Is service anticipated to be lower than level C? Is level E or F expected? Deteriorating service can mean delays for drivers (or detours to avoid the congested street); air pollution from backed up cars; and a greater need for street improvements such as wider pavements, signals, one-way loops and no-parking regulations.

Officials who normally deal with traffic and traffic improvements in the community (e.g., selectmen, highway surveyor or superintendent, chief of local department of public works, police chief and/or traffic safety officer, representatives of the state D.P.W. area office) can help consider or review the scope of improvements that might be needed. Note that improvements and similar measures not only have financial costs, but other costs as well: trees cut down, front yards sliced off, retail sales reduced as parking and driving become more difficult, and greater public controversy.

Example

To illustrate, suppose a two-lane road serving residential traffic now carries 6,000 vehicles per day. Peak hour traffic is estimated to be 10% of that, or 600 vehicles (Step 2.3, page 33). A site is being considered for rezoning from agricultural to single-family residential use. Future development off this site but also served by the street is estimated to add 150 vehicles per hour to the current 600 (Step 2.4, page 33). If rezoning is approved, the most probable outcome is that a 250-unit development served only by that street will be built, involving 250 units x 8.5 trips/unit x 10% in peak hour, or the addition of 210 trips in the peak hour (Step 2.5, page 33), bringing total peak hour traffic under this outcome to 960 vehicles. If rezoning is not approved, it appears most likely that the site will remain undeveloped for some time to come, adding no new traffic under that outcome. This means a 60% increase in peak hour traffic under the

first outcome (250-unit housing development) (150 + 210 ÷ 600) and a 25% increase under the second outcome (no new development on agricultural site) (150 ÷ 600). (See Step 2.6, page 33 .)

Current level of service is judged to be level B, based on residents' consensus (Step 4.1, page 38). The 25% increase in peak hour traffic will lower the level of service by 1+ steps (25% ÷ 15%) to level C or possibly to level D. The 60% increase in peak hour traffic will lower the level of service 4 steps (60% ÷ 15%) or to level F (Step 4.2, page 38).

Actually, level F might not occur. Street capacity improvements might be made, or congestion might divert traffic onto other streets, or the traffic would be so bad, not all of the planned 250 dwellings would be built and occupied, or public transport might be provided.

QUALITY OF LIFE

Substantial traffic increases can affect the quality of life on property along nearby streets, even if there are no major safety or congestion problems. More cars mean more air pollution, noise, vibrations and traffic dangers; in some cases, the street may have to be widened or straightened. All these changes can make a residential street a much less pleasant place to live on. Pedestrian use of sidewalks may decrease. Front lawns and porches may become less peaceful and comfortable. Children may no longer be able to play near the street. Noise may disrupt family conversations. The street may no longer serve as a focus of neighborhood life.

Noise and vibration levels can be quantitatively related to traffic flow and to human discomfort and annoyance (Figure 2-3). Stop-and-go traffic flows and a high incidence of truck traffic are special problems.

REQUIRING ANALYSIS FOR SPECIAL PERMITS

Professional analysis is appropriate for proposals likely to have large or unclear impacts. In many cases, the developer of a major traffic generator can be required to submit a traffic analysis as part of a special permit application.[1] The community can require such an analysis in the following way.

---

[1] Developers sometimes need such studies anyway, in order to design the final site plan for large developments and/or to apply to the State Dept. of Public Works for a curb cut on a state road.

FIGURE 2-3
LOUDNESS RANGE OF COMMON TRAFFIC SOUNDS
(Measured at Source or Indicated Distance)

Sound Source	dBA	Response Criteria
	120	
Auto horn (feet)		Maximum vocal effort
	110	
	100	
		Very annoying
Heavy truck (50 feet)	90	Hearing damage (8 hours)
	80	Annoying
Freeway traffic (50 feet)	70	Telephone use difficult
		Intrusive
	60	
Light auto traffic (50 feet)		
	50	Quiet
Living room		
Bedroom	40	
Soft whisper (15 feet)	30	Very quiet

Source: Adapted from Dale Keyes, Land Development and the Natural Environment, Washington, D.C.: Urban Institute, 1976, p. 107.

Only Allow Major Traffic Generators on Special Permit

Table 2-7 suggests land uses likely to generate more than 250, 500, and 1,000 trips per day. The lower number may be an appropriate threshold for requiring special permits in small rural communities; the higher number may be appropriate in large communities.

Listing Traffic Criteria for Special Permit Approval

Possible criteria[1] are that major traffic generators should:

a. Provide at least 400 feet visibility in each travel direction[2] at egress points;

b. Not have any street egress within 250 feet of either an intersecting street or an egress from a parking area serving 30 or more vehicles;[3]

c. Not result in traffic above the level C service capacity of roads and intersections at any point within a half mile, using definitions and methods of estimation as outlined in the Highway Capacity Manual, 1965 or later editions;

d. Not increase average daily traffic by more than 25% above then-current levels on any street within a half mile;

e. Not increase average daily truck traffic by more than 25% above current levels on any street within a half mile;

f. Provide access to an arterial or collector street via ways serving not more than 10 single-family homes.

Require Submission of Professional Analysis

Analysis by a qualified traffic engineer can be required, including:

a. Calculations at critical locations to show compliance with the criteria.

b. A narrative statement describing any traffic safety problems that may result.

c. A narrative statement suggesting actions by the developer or the community that would be needed to provide compliance with the criteria.

---

[1] These criteria are illustrative and should be adjusted for any particular community.

[2] See Page 35 for more detailed standards.

[3] See Page 35 for more detailed standards.

TABLE 2-7
MAJOR TRAFFIC GENERATORS

Land Use	likely to have more than: 250 trips per day	500 trips per day	1,000 trips per day
Residential			
Single-family homes	30+ du	60+ du	120+ du
Multi-family	40+ du	75+ du	150+ du
Mobile homes	40+ du	80+ du	160+ du
Commercial			
Shopping center	Any	Any	Any
Supermarket	Any	Any	Any
Carwash, gas station	Any	Some	--
Drive-in bank	Any	Any	Any
Other stores	5,000+ gsf	10,000+ gsf	20,000+ gsf
Fast food restaurant	Any	Any	Any
Other restaurants	1,500 gsf	3,000 gsf	6,000+ gsf
Hotel, motel with convention facilities	Any	50+ rooms	100+ rooms
Other motel	45+ rooms	90+ rooms	180+ rooms
Industrial			
Industrial (in general)	4+ acres	8+ acres	15+ acres
Manufacturing[a]	100+ employees	200+ employees	400+ employees
Industrial park	Any	Any	Any
Warehouse	50+ employees	100+ employees	200+ employees
Truck terminal	Any	40,000+ gsf	80,000+ gsf
Office			
Office building	25,000+ gsf	50,000+ gsf	100,000+ gsf
Medical office building	Any	10,000+ gsf	20,000+ gsf
Institutional			
General hospital	Any	Any	70+ beds
Long-term care hospital	70+ beds	140+ beds	280+ beds
College	Any	210+ students	420+ students
Airport	Any	140+ acres	280+ acres

TABLE 2-7 (continued)

Land Use	likely to have more than: 250 trips per day	500 trips per day	1,000 trips per day
Recreation			
Stadium	250+ seats	500+ seats	1,000+ seats
Drive-in theatre	Any	250+ spaces	500+ spaces
Golf course	Any	90+ acres	180+ acres
Marina	60+ berths	120+ berths	250+ berths
Ski area, skating rink, beach, movie theatre	Any	Some	Some

gsf = gross square feet of building floor area
du = dwelling unit

[a]Also research and development.

Sources: Based on Table 2-2 data. Format based on Martha's Vineyard Commission, "Table of Regional Traffic Generators," October 1975.

PROFESSIONAL ANALYSIS FOR OTHER PROPOSALS

In some cases, a major traffic generator will be proposed but the community does not or cannot require a special permit. In such cases (e.g., a rezoning, a proposed public facility, etc.), public officials might want to roughly estimate possible impacts to see whether a professional analysis is needed. If they decide one is needed, the community could provide the analysis itself (staff or outside assistance) or request that those making the proposal provide a traffic analysis. Such analysis might be similar to that described for a special permit.

CHAPTER 3

PUBLIC FACILITY IMPACTS

This chapter considers the impacts of development on major public facilities, impacts that could, for example, result in the need for a new school or wellfield. Street improvements are discussed separately in this guidebook in the Traffic Impacts chapter. Normal agency operations (personnel, assignments) are included in the Fiscal Impacts chapter in the way that they are reflected in the tax rate.

New development normally increases pressure on public facilities. The development may substantially increase water use, sewage flows, storm water runoff, or number of school children. Where the new demand passes or brings nearer a "break point," major capital improvements may be required. Sometimes, expanding demand is not responded to by expanding facilities, but in that case, too, a price is paid: more crowded facilities, less efficient operations, reduced services, perhaps higher insurance rates (e.g., fire insurance).

New development can also have positive impacts on the community. For example, higher densities may make new services and conveniences such as public trash collection or public sewerage feasible for the first time. A first-rate public library with convenient hours may finally be justified. Sometimes, a developer extends services and amenities beyond his development to previously unserviced areas.

Following are common questions about new development:

1. Will the development require (immediately or eventually) a type of public service not now provided in the area (such as public water, public sewerage)? Might it make desired services feasible for the first time?

2. Will development overload capacity of existing facilities, or make it hard to accommodate other expected growth? If new services are extended by a developer, will other expected growth be more easily accommodated?

3. Will major capital improvements be needed, such as additions, extensions, new facilities?

4. Some of the improvements may be needed or already planned regardless of the development. Will the proposal accelerate their timing or increase their scale (and cost)?

5. Are there likely to be serious time lags before the proposed development can be adequately serviced? This may suggest phasing the development.

6. Are there likely to be problems borrowing for the improvements? Large-scale borrowing may be difficult or impossible for small communities or service districts.

7. Will there be long-term fiscal effects? The development's share of debt service costs can be estimated. If the facility is provided by the municipal government, debt service can be compared with revenues (and other costs) from the development (see "Fiscal Impacts," page 63).

As with other impacts, the probable outcomes of both approving and rejecting a proposal should be made explicit. The consequences of these outcomes for facilities should then be predicted and compared. Net differences may sometimes be slight, perhaps depending only upon which year the improvements will be needed.

Experts

Analysis of facility impacts must depend upon a variety of experts. It is important to understand that facility "need" is not often objectively determinable, and that the expert's role naturally colors his perception of need. Beware: treat expert input with some skepticism. Some common role influences:

The elected or senior appointed facility manager: he will often minimize limitations of facilities he is responsible for, since doing otherwise reflects on the job he has been doing. Exception: the new manager of "inherited" facilities, which he'll often find grossly inadequate.

The professional facility designer: engineers and architects generally use very conservative assumptions when evaluating facilities. This reflects both a general concern not to under-design facilities and also the general orientation (and self-interest) of the profession toward building newer, bigger and better facilities. If the professional designer finds a facility adequate, it probably really is. If he finds facilities inadequate and in need of expansion or replacement, it is often valuable to review his assumptions.

The national organizations: librarians, policemen, firemen, recreationists, and others all have their state, regional, or national standard-

setting organizations. The dynamics of these organizations is clear: their "standards" are seldom "norms," really being "goals." That's fine if understood.

SCHOOL FACILITIES

To estimate impact on need for school facilities, the following steps are required:

a. Define the possible development outcomes resulting from alternative land use decisions (approving or rejecting a rezoning, for example). For each outcome that seems sufficiently likely to warrant study, estimate enrollment from development for selected future years, by grade grouping: elementary, junior high, senior high. In the Fiscal Impacts chapter, we outline how to estimate total school enrollment resulting from development (page 71). Allocating estimated enrollment among grade groupings is even more uncertainty-prone than the basic estimate. We do not find national or other non-local studies useful for this, but instead suggest allocating students to grade levels based on local experience. For example, suppose that a development is estimated to add 400 children to the schools when fully developed. If 60% of all current local enrollments are in grades K-6, a reasonable first approximation is that 60% of these 400 children will also be in grades K-6, or 240 children in those grades. Enrollment impact should be estimated for selected years based on the phasing schedule of development (see page 49). The total enrollment figure will only be reached when development is fully occupied.

b. Allocate those enrollments to existing or committed future facilities, based on school district lines. For example, the proposed project might be served by two school districts. Half of the students, or 120, might be allocated to each.

c. Estimate future enrollments in the affected schools expected from all areas outside the site whose rezoning (or other land use change) is being considered. The school department may already have made a detailed projection. The Bureau of Research and Assessment, Massachusetts Department of Education, has made projections by grade groupings for each school system in the state.[1] Upon request, they will project enrollments by district

[1]Department of Education, Bureau of Research and Assessment, "Enrollment Projections for Public Schools in Massachusetts, 1975-1979," October 1975.

within the school system; simply provide them with district enrollments by grade for the last ten years.

d. For each development outcome defined in (a), add enrollment from potential development to that expected anyway from outside the site. Example: Assume a community can either approve or reject a site rezoning from single-family to multi-family residential use. Also assume that each decision will result in one probable outcome. If rezoning is approved, multi-family development of predictable scale will indeed occur on the site, as well as normally expected growth off-site. If rezoning is rejected, single-family development of a predictable scale will result on-site. Off the site, growth will also occur as in the first case. But it will occur at a slightly greater intensity because the demand for new multi-family housing, frustrated on-site, will likely be accommodated elsewhere off-site in addition to the normally expected growth. Projected district enrollments for a selected grade grouping can be tabulated as follows:

Outcome 1: Multi-family development occurs after rezoning is approved.
Outcome 2: Single-family development occurs after rezoning is rejected.

Year	Projected Enrollment From Outside the Site		Projected Enrollment From On-site Development		Total	
	Outcome 1	Outcome 2	Outcome 1	Outcome 2	Outcome 1	Outcome 2
1977	640	650	30	20	670	670
1978	650	660	60	30	710	690
1979	640	650	90	50	730	700
1980	630	650	120	70	750	720
1985	580	600	120	70	700	670
1990	580	600	120	70	700	670

e. Compare totals and evaluate the results. Do the totals ever exceed current levels? Given falling birth rates, they might not. Do they ever exceed the School Department's suggested capacity for the school? If so, by how much, and for how long? If overcapacity results, can it be resolved by redistricting, or will more heroic efforts be required, such as double sessions, or a new building or building addition?

RECREATION FACILITIES

In assessing consequences of residential development on recreation facilities, the following should be considered:

a. Determine what facilities the development itself is going to provide. Many, especially clustered developments, internally provide facilities completely satisfying some recreational demands, such as for tennis.

b. Ask whether those who operate local recreation programs consider that recreation programs are now constrained by lack of adequate facilities (rather than, say, lack of staff or other problems).

c. Assess whether it is likely that the added recreational demands will be satisfied incidental to satisfying school needs. The site standards of the School Building Assistance Bureau result in adding one acre per 100 added pupils. Well managed, this space may be all the recreation space that a community need add as it grows.

d. Check quantitatively. Standards keep rising, but about five nearby acres of recreation space per 1,000 residents is reasonable for communities with less than 50,000 population.[1] This means that each added 100 residents may create a need for another half-acre of recreation space. A simpler and perhaps more reliable rule is that adding recreation space in direct proportion to population growth would probably, in most cases, more than keep pace with added demand:

$$\text{Added space justified} = \frac{\text{Population in proposed development}}{\text{Current population of community}} = \text{Recreation acres now in use}$$

e. Assess impact on special facilities or programs. Impact can be good or bad. Swimming might be made overcrowded, or it might be made justifiable for the first time. It is difficult to generalize from town to town about the demand for specific facilities. Statewide Comprehensive Outdoor Recreation Plans (SCORPS) provide capacity standards for different kinds of facilities which may be of local use. They also identify facilities needed to meet excess demand, but at a regional level of detail.[2]

---

[1] National Recreation and Park Association, "Outdoor Recreation Space Standards," New York, 1965.

[2] Department of Environmental Management, "Massachusetts Outdoors: Statewide Comprehensive Outdoor Recreation Plan," 1976.

WATER

Following are some key impacts to watch out for:

a. Need for a Public Water System. If there is now no public water system in the area, will the development accelerate the time when one is needed? Population growth makes public water supply more likely. This may mean creation of a new water district or expansion of an existing district. Table 3-1 shows expectations of public water systems for residential areas.

TABLE 3-1
LIKELIHOOD OF PUBLIC WATER SYSTEM

Population Density (Persons/Sq.Mile)	Equivalent Lot Size[a]	Likelihood of Eventual Public Water System
over 2,500	less than 1 acre	nearly certain
1,000-2,500	1-2 acres	eventually in most cases
500-1,000	2-4 acres	unlikely
less than 500	over 4 acres	virtually never

[a] if fully developed

Source: U.S. Dept. of H.E.W., Public Health Service, Environmental Health Planning Guide, 1962.

b. Pollution. Would proposed development pollute water supplies by changing drainage patterns, increasing runoff and sedimentation, discharging wastes, or placing a sewage disposal system near wellfields or surface water bodies? The result may be lower water quality, requiring some form of treatment or, conceivably, need for another water supply.

Statewide standards govern the distance of water supplies from pollution sources. In Massachusetts, no well may be located within half a mile of potentially serious pollution sources such as sanitary landfills, major fuel storage and/or transmission facilities, road salt stockpile areas, hazardous substances storage areas, etc., without special approval. A minimum area around the well must also be acquired by the water supplier and set aside and controlled to protect the water from contamination. For example, a circle of 400-foot radius must be controlled around a gravel packed well.[1]

[1] Massachusetts Department of Environmental Quality Engineering, "Guidelines for the Establishment of New Sources of Groundwater for Community Water Systems," April 1975, and "Drinking Water Regulations of Massachusetts," June 1977.

Standards such as these are general minimum standards and may not be adequate in every situation. Critical distances within which pollutants will drain toward groundwater supplies are a function of the region's groundwater recharge rate and the well's pumping rate. It has been estimated that a recharge rate of 16 inches per year (applicable to much of Cape Cod, for example) and a well pumping rate of a million gallons per day will yield a circle of 3400 feet radius around a well that may be impacted by sources of pollution.[1] Professionals can estimate critical distances and help check the adequacy of standards in individual cases.

c. Effect on Water Level. If the development has its own wells, will it reduce water table levels in surrounding areas, possibly affecting public wellfields? Pond levels may also be reduced with impacts on recreation facilities, as well as on ecology and aesthetics. Impact many sometimes be lessened by employing several small dispersed wells rather than one large one. The developer's engineer can be asked to document potential impacts on water levels.

d. Need for Public Improvements. If the development will use the public system, will it require major improvements in that system? Improvements might include:

1) New water mains. Existing mains may have to be extended a considerable distance to the site. Nearby mains may have to be replaced by larger ones or supplemented in order to provide adequate pressure for fire fighting. Check with water officials and the fire chief. (A major apartment complex, for example, might need 12" mains rather than the present 6" or 8" mains in the area.) Arrangements often provide for the developer to pay part or all of the cost for the new mains.

2) Additional storage capacity. Larger storage facilities may be needed to provide adequate reserves for peak demand plus fire fighting. Standpipes and water tanks may have to be built or expanded; insurance rates go up if underwriters believe reserves are inadequate. Concern may be greatest for very large new developments (such as an industrial park) which

---

[1] Arthur N. Strahler, "The Environmental Impact of Groundwater Use on Cape Cod," Association for the Preservation of Cape Cod, Orleans, Mass., 1972.

increase needed fire flows in the community.[1]

3) Additional supplies. Extra demand from the development may exceed the capacity of existing water supplies. This can sometimes be readily dealt with by increasing pumping capacity or tapping another known groundwater or surface water source. If these solutions aren't available, consequences may be much more serious. Search for a new source may prove fruitless. Water may have to be purchased from elsewhere (e.g., from another district in the community, a nearby city or town, the Metropolitan District Commission). It often takes years to find and develop a new source or to work out arrangements with another district; water shortages may occur in the meantime. By contrast, new mains, standpipes, pumps are costly but relatively straightforward improvements.

Where impacts may be significant, the proposal should be carefully reviewed by the Water Commissioners (or department) and/or by outside engineers (provided by the developer or the community). Following is a quick general approach for considering how the water use of the proposal might affect public water supplies.

1. Review Existing Conditions and Plans

Water system records, personnel, and engineering studies may indicate:

-- water use on the average and maximum days during the year (maximum, rather than average, demand is sometimes the more important design criterion);

-- supply capacity: how many gallons can be pumped on a single day;

-- how current use compares with capacity; proposal impact will naturally be much more critical if the system is already close to capacity;

-- problems that have already been identified;

-- improvements that are already planned or underway.

2. Estimate Water Use for the Proposed Development

How many gallons would be needed on the maximum day?

a. Residential development. Residential water serves two main purposes: household use and sprinkling. Household consumption often averages

---

[1]See Insurance Services Office, "Guide for Determination of Required Fire Flow," New York, 1974.

about 250 gallons per dwelling per day.[1] Sprinkling varies widely, depending on the size of the lawn. In an apartment complex only 100 gallons per dwelling unit might go to sprinkling. In a 1-acre or 2-acre area, sprinkling might reach 1,000 or 2,000 gallons per dwelling unit on the maximum day.[2] Implications:

1) One can roughly estimate water use per dwelling. If proposed densities aren't very different from existing densities in the community, look at current water records for the system:

$$\text{Max. Day Use per Dwelling Unit} = \frac{\text{Total Residential Use on Maximum Day}}{\text{\# of Residential Connections}}$$

Be careful to count only residential uses; don't count stores and factories.[3] For a rough estimate, maximum day use is often about 400-800 gallons per dwelling (toward the low end of the range for apartments, toward the high end for single-family homes).[4]

2) Increasing residential density does not always increase maximum day water use. This is the surprising finding of a nationwide study.[5] Water use per acre may not change very much whether there are, say, one unit or five units per acre, since total lawn area remains about the same. It may therefore sometimes be useful to estimate water use per acre (total current residential use ÷ residential acres).

At still higher densities (especially more than 10 units per acre), maximum day water use clearly does increase with increasing density. Household consumption for each extra unit is greater than reduced sprinkling from reduced lawn area.

---

[1] F.P. Linaweaver, John Geyer and Jerome Wolff, "A Study of Residential Water Use," for Federal Housing Administration, 1967.

[2] Source: Richard Bond and Conrad Straub (eds.), CRC Handbook of Environmental Control, Vol. II, Water Supply and Treatment, 1972.

[3] Some per capita figures are based on all water use divided by population. The result can be misleading if there are large commercial or industrial users in the community.

[4] Assumes maximum day is about double the average day, about 2.5-4.0 persons per dwelling, and 60-100 gallons per capita on an average day. See: estimates of Mass. Dept. of Public Health; Real Estate Research Corporation, The Costs of Sprawl, for the U.S. Council on Environmental Quality, 1974; Linaweaver, Residential Water Use; Wallace, Floyd, Ellenzweig, Moore, Inc., Massachusetts Water Supply Policy Study, prepared for Massachusetts EOEA, Boston, 1977.

[5] Linaweaver, op.cit.

b. Non-Residential Development. Water use varies enormously by type of development, depending on needs for employees, visitors, and industrial processes. Examples (for illustrative purposes; some data is quite old):

Land Use	Rough estimate, gallons per day per employee[1]
office	15
shopping center	30
printing	300
chemicals manufacturing	2,000
paper manufacturing	6,000

Even for the same type of development, water use may vary widely among individual establishments. Restaurants, for example, may generally average 35 gallons per seat per day, but counter seats in a turnpike rest area might generate 10 times as much.[2]

Each non-residential development should therefore be reviewed in terms of its particular characteristics. The developer may be asked to provide an estimate of daily water use. One can also look at similar establishments elsewhere.

3. Compare the Development to Current Water Use and Capacity

Does the development substantially increase water use in the district? Will existing supplies be adequate to meet the extra demand? Even if the development won't exceed existing capacity, it may still cause problems: making it hard to deal with major fires and to accommodate other expected development and rising demand from present users (perhaps increasing about 1% per year,[3] but each community must examine its own recent water use trends which may have significantly changed as a result of metering, perception of shortage, etc.).

---

[1] Total water consumption for all purposes divided by number of employees; Bond and Straub; Metcalf and Eddy, Inc. Wastewater Engineering: Collection, Treatment, Disposal; Wallace, Floyd, Ellenzweig, Moore, Inc., Massachusetts Water Supply Policy Study, prepared for Massachusetts EOEA, Boston, 1977; Herr Associates estimates for shopping centers based on water records for Burlington Mall, South Shore and North Shore Shopping Plazas.

[2] Metcalf and Eddy, Wastewater Engineering.

[3] New England River Basins Commission, How to Guide Growth in Southeastern New England, May 1975.

4. Consider What Improvements May Be Needed

Ask those in charge of the water system. Issues can include timing, cost, and complexity of arrangements. Consideration might also be given to water conservation actions, either short-term in the form of emergency use restrictions, or long-term actions such as public education and encouragement (perhaps by code reform) of new water savings plumbing fixtures.

SEWERAGE

Concerns vary, depending on whether the development will provide its own sewage disposal or be served by a public system.

Private Disposal

What degree of assurance is there that the system will prove adequate not only initially, but in the long run? Initial adequacy can be assured by capable administration of the State Environmental Code and Board of Health regulations. Long-term adequacy is far more complex, since initially adequate systems often, in time, prove troublesome, leading to eventual provision of public sewerage. Long term maintenance demands of individual septic tanks and consumer convenience are not the only issues. Of prime concern are the water quality implications, since even a perfectly functioning on-site system may be effective in removing such pollutants as nitrates and phosphates.

Expectations for residential development are as follows:

TABLE 3-2
LIKELIHOOD OF PUBLIC SEWERAGE

Population Density (Persons/Sq. Mile)	Equivalent Lot Size	Likelihood of Eventual Public Sewerage
Over 5,000	Under 1/2 acre	Nearly certain eventually
2,500-5,000	1/2 to 1 acre	Eventually in most cases
1,000-2,500	1 to 2 acres	Unlikely
Less than 1,000	Over 2 acres	Virtually none

Source: U.S. Dept. of H.E.W., Public Health Service, Environmental Health Planning Guide, 1962.

Poor soils, steep topography, high water table, or proximity to critical waterbodies increase likelihood of eventual sewerage; good soils, flat land, and deep water table reduce likelihood. There are lots of exceptions. A recent soil survey by the U.S. Soil Conservation Service can provide valuable information.

The Planners Handbook contains a table relating soils, lot size, and other site considerations to adequacy of private disposal.[1] If the proposed development violates the standards of that table, skepticism about long-term adequacy is well-justified, percolation tests notwithstanding.

Municipal System

If the development is likely to be served by the municipal sewerage system, several questions follow:

a. Is there adequate trunkline capacity to serve the development. The question should be answered by a technician, but if problems already exist, or if the development is only a tiny fraction of the current total load served by the line in question, the answer may be obvious, one way or the other. Ask those in charge of the sewerage system.

b. Is there adequate treatment plant capacity to serve the development? Again the question requires technical response, but again the answer may be obvious. Ask those in charge.

Sometimes capacity inadequacy can be remedied by relatively inexpensive actions such as blocking stormwater infiltration to reduce peak flows. On the other hand, sometimes a relatively small increment in sewage flows is the last straw, precipitating major system additions. Again, lay judgment is difficult. Major system additions may also induce still more development; these secondary impacts should not be overlooked.

c. If development is non-residential, will the character of its waste discharge be compatible with the existing municipal system? If pretreatment is appropriate, will it be assured?

---

[1] Massachusetts Federation of Planning Boards, Planners Handbook, Braintree, Mass., Revised 1975.

STORM DRAINAGE

Development replaces soft absorbent surfaces with hard impervious ones, and often replaces slow over-ground runoff routes with rapidly-flowing piped underground ones. The result is that storm water gets to the bottom of hills or into streams faster, increasing peak flows (and often reducing off-peak flows since less water is held back to flow later). The public facility impact is that storm drainage facilities such as storm sewers or culverts downstream of a development may prove inadequate and require expensive replacement.

Modern design, management, and regulation can virtually eliminate the problem. In many locations, it is feasible to insist upon development design to avoid peak flow increases through use of recharge, roof storage, parking area storage, and grassed ponding areas.[1]

Further, initial design of downstream facilities can be based upon the estimated flows given full development uphill, rather than assuming uphill areas will remain undeveloped.

If regulations and earlier design practices didn't follow this approach, development is likely to add to peak runoff. The computations for runoff are complex and may include such factors as land use, amount and distribution of impervious surfaces, amount of area served by storm sewerage, soil type, slope and vegetation. To get a "ballpark" sense, the following "runoff multipliers" might be considered.

-- Developed for single-family lots, runoff = 2 times undeveloped runoff rate,

-- Developed for multi-family units, runoff = 3 times undeveloped runoff rate,

-- Developed for business, runoff = 4 times undeveloped runoff rate.

The impact on the total drainage catchment area involved can be crudely estimated as:

$$\frac{\text{Area of proposed development} \times \text{runoff multiplier} \times 100}{\text{Area of total drainage catchment area}} = \%\ \text{increase in runoff}$$

For example, 100 acres of undeveloped land are proposed for multi-family use. It is part of a 1,500-acre drainage basin served by a critical road culvert.

---

[1] Urban Land Institute, American Society of Civil Engineers, and National Association of Home Builders, Residential Storm Water Management, 1975.

$$\frac{100 \text{ acres} \times 3 \times 100}{1{,}500 \text{ acres}} = 20\% \text{ increase in runoff}$$

If the increase looks critical, have it analyzed by a professional. There is much more than shown here: the increase in peak flow may be either a great deal more or a great deal less than 20%.[1]

Regulation might also address runoff water quality. Runoff from major roads can contain salt and petroleum products.

SOLID WASTE

Two "break points" are involved in solid waste: the point at which pickups begin, and the point at which the disposal facility is overtaxed (incinerator) or exhausted (landfill).

Collection

Justification for collection service in relation to density is shown in the following.

TABLE 3-3
JUSTIFICATION FOR SOLID WASTE COLLECTION

Population Density (Persons/Sq. Mile)	Equivalent Lot Size	Economic Justification for Collection Service
Over 2,500	less than 1 acre	Service justified
1,000-2,500	1 to 2 acres	Service normally justified
500-1,000	2 to 4 acres	Service seldom justified
Under 500	over 4 acres	Service rarely justified

Source: U.S. Public Health Service, Environmental Health Planning Guide.

By calculating the difference in density which a proposed development makes, one can estimate the degree to which it accelerates the time when collection service may be required.

---

[1] To get a sense of impact magnitudes, conversion of a small river basin from rural to 20% impervious and 20% sewered might increase by 50% the basin's average annual flood; this would result in a doubling of the number of overbank flows. See U.S. Environmental Protection Agency, Office of Research and Monitoring, Stream Quality Preservation through Planned Urban Development, Washington, D.C., 1973.

Disposal

Nationwide, the rate of solid waste generation had been rising for many years until stabilizing in the past few years at about 0.6 tons per resident per year. For businesses, the following is an approximation.

TABLE 3-4
SOLID WASTE GENERATED BY BUSINESSES

	Tons per employee per year
Offices	0.4
Textile, apparel, manufacturing	0.7
Transportation, communication, utilities	1
Metal, machinery manufacturing	1
Printing, publishing	4
Chemical, plastic manufacturing	7
Paper manufacturing	9
Food processing	10
Wood products, furniture	15

Source: Adapted from Raytheon Service Co., Solid Waste Mangement Study Report, for Mass. Dept. of Public Works, 1972.

The remaining capacity per day for a local incinerator or total remaining capacity for a landfill can normally be estimated by the operating agency. Using these multipliers, one can estimate the extent to which a proposed development will draw on that capacity.

OTHER COMMUNITY FACILITIES

As communities grow, pressure on a broad range of community facilities grows. First, more people simply means more people having business at town offices, borrowing books at the library, and having homes needing fire protection. Second, service-level expectations are higher for larger communities. Inconveniences or lack of amenities accepted in a rural community cease to be acceptable as the community grows. Third, better facilities generate greater usage. A small municipal library may initially attract few users. But if the facilities are improved, per capita usage may grow enormously.

Often the change is subtle and gradual, as when the same town office building which served a town of 6,000 continues to serve it at 15,000, but does so by virtue of a series of displacements over time: moving the town meeting to the school auditorium, police to a separate police station,

public works to a separate building, and the welfare department to an adjacent town.

Development demand for several types of facilities are discussed below.

Libraries

The American Library Association suggests a library floor space standard of about 0.7 square feet per capita for communities under 50,000 residents.[1] We find few communities which meet that standard, but it probably is a fair measure of growing demand. Thus, a development bringing 1,000 new residents brings demand for about 700 square feet of library space.

Municipal Office Space

By observation, we judge that demand for floor space for town offices and police headquarters also grows by about three-quarters square foot per capita.

Fire Protection Facilities

Demand for fire protection facilities in communities of under 50,000 largely depends on the pattern of development. Insurance rates depend, among other things, upon proximity to fire stations. A usual standard for proximity is:

TABLE 3-5
PROXIMITY OF FIRE STATIONS

	Engine, Hose or Engine-Ladder Co.	Ladder Co.
Commerce, Industry		
Dense	3/4 mile	1 mile
Other	1-1/2 miles	2 miles
Residential		
Multi-family	1-1/2 miles	2 miles
Lots smaller than 1 acre	2 miles	3 miles
Lots larger than 1 acre	4 miles	4 miles

Source: Adapted from American Insurance Association (National Board of Fire Underwriters), "Fire Department Standards: Distribution of Companies and Response to Alarms," Special Interest Bulletin No. 315, Jan. 1963.

[1] American Library Association, Public Library Association, "Interim Standards for Small Public Libraries: Guidelines Toward Achieving Goals of Public Library Service," Chicago, 1962.

Buildings with dimensions, either horizontal or vertical, much greater than others in the community can precipitate demand for fire fighting equipment not otherwise available or required. The equipment, in turn, can require types of garage space not now available. Check with the fire chief: this could be an expensive and unanticipated impact.

SUMMARY CHECKLIST

The following chart organizes the public facility impacts discussed in this chapter.[1] If more than one facility within a single category is impacted, the impact data should be reported separately for each. If new development will be phased, capacities should also be reported by phase.

Type of Facility	If Nonexistant	If Exists			
	Will new facilities be demanded or made feasible for the first time?	Percent of Capacity Used			If Overload, Earliest Time of Relief (in months)
		Outcome 1	Outcome 2	Other	
1. School facilities - elementary - junior high - senior high					
2. Recreation - pools - parks - ...					
3. Water - water mains - storage - supplies - pollution impacts		N.A.	N.A.	N.A.	N.A.
4. Sewerage - trunklines - treatment plant					
5. Storm drainage - sewers - culverts					
6. Solid waste - collection - disposal					
7. Libraries					
8. Municipal office - police - government					
9. Fire protection facilities					

[1] Adapted from Schaenman and Muller, Measuring Impacts of Land Development, Washington, D.C.: Urban Institute, 1974, p. 36.

CHAPTER 4

FISCAL IMPACTS

Introduction

Fiscal effects of development are often a major concern. How will a proposal affect the local tax rate: will taxes from a development pay for the added police, fire, school and other services? Where a development requires major public improvements, another question may also be important: what will be the effect on the community's debt and its ability to borrow money for other needed improvements? This chapter suggests methods for answering these questions.

It should be recognized that the fiscal consequences of development depend heavily upon the fiscal system dictated by state law. Increasingly, state aid and fiscal law are aimed at equalizing tax burdens among municipalities, which means reducing the fiscal significance of "tax profitable" or "tax deficit" development. It seems likely that the future will see this trend continue. This could mean serious disappointment for any community which accepts otherwise undesirable development for tax tain that may be later legislated away, or for any community which denies otherwise desirable development because of presumed tax deficit that future legislation could offset.

This uncertainty has important implications:

— Predictions are perilous; note that methods and findings in this chapter are based on the current Massachusetts state-local fiscal system;

-- Fiscal impacts should not, as they sometimes do, monopolize study effort and attention; other issues may deserve more detailed study;

— Decisions on development proposals should not be based primarily on fiscal considerations, since they are hard to forecast and may be transitory.

Decisions based solely on fiscal considerations also raise ethical problems. Carried to an extreme, such decision-making results in social exclusion, identification of all children as liabilities, and distortion of patterns of economic growth.

Key Aspects of Development

Fiscal review of development proposals should usually focus on the following aspects of development which often have the largest fiscal consequences.

Residential v. Non-Residential. Commercial and industrial developments pay school taxes but do not directly add school children. They are usually fiscally profitable. Residential development is usually not as profitable; it is often subsidized by commercial and industrial uses.

Number of School Children. More children per dwelling unit means higher school costs and worse fiscal impact. This is usually the single biggest influence on fiscal balance of residential development. Number of children depends largely on the housing type and, especially, on the number of bedrooms per unit.

Multi-Family Tenure. Depending on local assessment practices, condominiums may pay considerably more in taxes than do similar rental units.

Seasonal Occupancy. Seasonally occupied units do not have school costs and cost less for other public services. They are much more profitable than year-round units. Be careful, however. Many "second" homes eventually become first homes.

Major Public Improvements. Developments which precipitate major increases in the capacity of public facilities (a new well, sewage treatment plant, school, etc.) can be unusually costly and affect the community's debt ratio and borrowing ability.

Phasing of Development. The phasing of the development can have a critical effect on the timing of required public improvements and on the community's ability to extend its services and facilities in a gradual and planned manner.

Special Tax Arrangements. In Massachusetts, developments "taxed" under Chapter 121A arrangements pay much smaller tax revenues to the community than do conventionally taxed developments. But, 121A developments don't add to the community's assessed valuation -- and because state aid to communities is roughly inversely proportional to their assessed valuation, 121A developments don't diminish state aid in the way conventionally assessed developments may.

Internal Services. Large developments may provide many of their own services (such as security guards, recreation facilities, water supply), reducing the public service costs.

Suggestions for Fiscal Studies

Fiscal studies deal with many factors and often raise questions about what should and should not be counted. The following general suggestions may be useful.[1]

Focus on Change in the Tax Rate. Don't stop after a calculation of fiscal gain or loss. It is in the tax rate where property owners will feel the real fiscal effect of a development. During the calculation, measure costs and revenues at consistent points in time; for example, don't weigh costs accruing in five years against benefits accruing one year after development is completed. One might assume that development had been in place and operating one year ago, or five or ten years in the future. It may be useful to calculate impact on the tax rate at several points in time.[2] Assume that current levels of service in the community will be maintained (which may well not be true).

Count Both Costs and Revenues. A developer may only point out the new revenues his development will provide. Opponents may only point out the new school that will be needed. Both elements should be taken into account.

Be Consistent in the Portion of Costs and Revenues Analyzed. Normally, analysis should be confined to those costs funded by property taxes, excluding those paid by excise taxes, revenue sharing, state aid, etc., and comparing those costs with revenues derived from property taxes. Change in level of state school aid should also normally be analyzed, especially in the case of development involving few or no school children, since the level of that aid is often strongly affected and is highly significant to the tax rate.

---

[1] See also Thomas Muller, Fiscal Impacts of Land Development, A Critique of Methods and Review of Issues, Washington, D.C.: Urban Institute, 1975.

[2] Normal assumptions are that (a) inflation can be ignored because the development's revenues would increase just as its costs do; and (b) the development is a net addition to the community; even if the residents and shops occupying it come from elsewhere in town, it is assumed that outsiders will move in to replace them.

Make Rough Estimates. Precise calculations are rarely worth the effort, since the basic assumptions of fiscal analysis (such as continuation of present state aid formulae) are quite crude. Local spending and tax rates, for example, change every year. Public services, by their nature, serve the entire community, so trying to identify the costs a particular development will add is at best an approximation.

Use Average Costs. Assume that new development has the same average costs (per pupil, per dwelling) as present development in the community. (These costs should include both operating and routine capital costs. They should not include the costs of major, exceptional public improvements. Where these are required, separately compute debt service attributable to the new development.) Rather than using average costs, one could try to figure out, item-by-item, all the marginal costs due to a development, that is, the actual added cost of added service. Such an approach is very time-consuming, however, requires many assumptions, may not add much accuracy, and, in fact, may underestimate the eventual costs of serving the development.

However, some caution is appropriate in using an average cost approach. It may be increasingly more expensive to service new development which overstrains facilities, even before major additions or improvements are necessary. On the other hand, underutilized facilities, such as half-empty classrooms, may easily accommodate new development at far lower costs than the pre-existing community average. In important and obvious cases, the average cost estimates for new development might be adjusted to reflect such economies and diseconomies of scale.

Treat School Costs Separately. They are the single largest item in local budgets, are easy to distinguish, and vary enormously by land use.

In Most Cases, Treat All Other Costs as a Single Item. There are many other public services, each of which makes up a relatively small fraction of total costs. Costs of each service attributable to a proposal are hard to identify separately. Ordinarily, line-by-line analysis of the local budget is probably only worth the extra effort where a very large development is proposed.[1]

---

[1] For examples of a line-by-line approach, see Adams, Howard and Opperman, "Comprehensive Development Plan, Town of Lincoln," 1965; Brookline Planning Department, "Residential Cost-Revenue Analysis," July 1973; and James Minuto, Cost-Revenue Study, Community Development Department, Cambridge, Mass., March 1976.

Steps in Fiscal Analysis

Conducting a fiscal analysis will require an assortment of data. It will save time to gather as much of this information as possible at the outset. What data is available might affect what time frame or method is selected for the analysis. A list of data helpful for a first-cut fiscal impact estimate follows with possible sources. See also Selected Bibliography.

Data	Sources
Number and mix of unit types of proposed development (or area if nonresidential)	Developer; real estate experts
Estimate of assessed value per unit of proposed development (or per sq.ft.) or estimate of revenues if commercial or apartments	Assessor; real estate experts; similar projects; developer
Community's actual tax rate, school tax rate, general tax rate, and total assessed valuation	M.T.F.;[1] Assessor; tax bill
Community's residential/non-residential assessment breakdown	M.T.F.;[1] Assessor; Bureau of Local Assessment, Dept. of Corporations and Taxation
Public school enrollment	School Dept.; State Dept. of Education, Division of Research, Planning and Evaluation, "Pupil Accounting Workbook"
Number of dwelling units in community	Master Plan; regional planning agency; building permit records from Building Inspector or State Building Code Commission; 1970 U.S. Census (for pre-1970 data)
Number of seasonal units (if significant)	Same
Number of single-family, garden, townhouse, condominimum, high-rise, etc. units	Assessor; Building Inspector (see above)

[1]Massachusetts Taxpayers Foundation, "Municipal Financial Data: Including 1977 Tax Rates" (updated annually), an excellent source of data for fiscal analyses in Massachusetts municipalities. See what is available here before looking further.

Data	Sources
Community's assessed valuation, population, and Assessment Ratio	MTF[1]
Community's current state school aid	School Dept.; Planning and Research Bureau, Dept. of Corporations and Taxation

The following steps are involved in estimating the tax impact of each development outcome.

1. Estimate revenues;
2. Estimate costs:
   - 2.1 School costs,
   - 2.2 Non-school costs,
   - 2.3 Change in state school aid,
   - 2.4 Extraordinary capital costs;
3. Calculate tax rate impact;
4. Adjust for secondary impacts, if any;
5. Devise means of mitigating any negative impacts.

Note that this method uses "no-build" as a baseline, and measures differences which any development outcome would make from that baseline. Any consistent time can be used; we suggest and illustrate using an historical analysis: what would have been if the development had existed in the most recent past year for which good data is available. The alternative is to project many independent variables, difficult and error-prone.

STEP 1. ESTIMATE DEVELOPMENT REVENUES

Revenues from each development outcome are equal to the actual tax rate times the assessed value of the property.

Revenues = Assessed Value (in $1,000's) x Actual Tax Rate

1.1 Estimate Assessed Value Per Unit of Development

Realistically estimate the assessment per dwelling unit or per square foot of building floor area. Approaches: obtain a ballpark figure from the

[1] Op.cit.

assessor based on the type and quality of development; check assessments of similar recent projects; or estimate the market value (from the developer or similar projects) and adjust it to reflect the Assessment Ratio for your community.[1] Remember, if the analysis is to be based on two-year old cost data, assessments should be those that would have been made two years earlier.

1.2 Determine Total Assessed Value of Development

Multiply the assessment per unit by the number of units (e.g., estimated $30,000 valuation per dwelling unit x 200 dwelling units = $6,000,000 assessed valuation; $10 per sq.ft. x 20,000 sq.ft. = $200,000 assessed valuation).

1.3 Estimate Property Tax Revenues

Multiply the assessed value of the development in $1,000's by the actual tax rate. Don't use the so-called "Full-Value (equalized) Tax Rate," since we aren't using full-value assessment.[2] Sample calculations are shown below:

Estimated assessed value (per dwelling unit)	$ 30,000
x Number of units	200
= Assessed value of development	$6,000,000
÷ 1,000	1,000
= Assessed value of development in $1,000's	$ 6,000
x Actual tax rate ($/$1,000's)	42.00
= ESTIMATED PROPERTY TAX REVENUES	$ 250,000[a]

[a] rounded off

A different approach is needed where property taxes are set as a percentage of rent. Many communities tax apartments and commercial properties at a certain percentage of the rent, usually between 15% and 25%. Revenues can be estimated in these cases by:

a. Finding out what percentage is normally used (and whether it is applied to the total rent roll) by checking with the assessor or looking at tax payments and rents of other projects.

---

[1] This is the ratio of the total assessed value in the community to the equalized ("full market") value of property in the community as estimated by the State Tax Commission. The ratio should be used cautiously for any particular development, since the degree of underassessment often differs among classes of property and between new and old property. Assessment ratios are listed in the Massachusetts Taxpayers Foundation, "Municipal Financial Data: Including 1977 Tax Rates" (updated annually).

[2] "Full-Value Tax Rate" = Actual Tax Rate x Assessment Ratio, and is useful for comparisons of town-wide fiscal trends over time, and comparisons across towns, but confuses this analysis if introduced.

b. Multiplying the percentage by the expected annual rent (developer's estimate or competitive projects);

Tax Percentage x Annual Rent = Estimated Property Tax Revenues

STEP 2. ESTIMATE DEVELOPMENT COSTS

2.1 Estimate Development School Costs

School costs are often the largest costs for residences and are estimated as follows. Though some analysts disagree, we allocate all school costs to year-round residences, none to seasonal residences or non-residential development.

2.1.1 Determine Total Local Cost of Education

The school tax levy is the total school cost (including capital costs) supported from local property taxes (after state aid and other offsetting revenues). The school tax levy (or "school assessment") can be obtained from the assessor.[1] Don't use total school expenditures or school appropriations, since these figures include costs not paid for by the property taxes being analyzed.

2.1.2 Compute Average Cost Per Pupil

Divide the school tax levy by total public school enrollment (from the school department).[2] This indicates the current average cost per pupil. We assume that new pupils will cost the same as present pupils, although in particular instances they may cost either more or less. Again, don't use published per pupil costs or ones furnished by the school department, since they include costs not paid for by property taxes.

---

[1] Or computed: School tax levy = Community's Assessed Valuation (in $1,000's) x School Tax Rate (from M.T.F., op.cit.).

[2] Enrollment should be for the same year as the school tax levy. It should include any pupils from the community who attend regional schools, but exclude private school pupils. If you use state-furnished or other standardized data, be sure what it includes. See Massachusetts Department of Education, Division of Research, Planning and Evaluation, "Pupil Accounting Workbook" for school enrollment tabulations for Mass. municipalities broken down into regional, vocational, and local and non-local public and private school enrollment.

2.1.3 Estimate Number of Public School Pupils Per Unit in Proposed Development

The number of pupils varies dramatically by type and age of dwelling (see Table 4-1 for a list of important factors). Don't use the current community average. If the proposal is similar to recent developments in the community, a survey of such developments might be valuable (door-to-door or from school department records). Otherwise, the following may be used:

> To get a local estimate for new homes, we often assume that a brand-new home averages one-and-one-half times the average number of children from existing homes in the community. Thus, for communities which are mostly single-family:
>
> $$\text{Est. Pupils Per New Single-Family Home} = 1.5 \times \frac{\text{Current Total Enrollment}}{\text{No. of dwelling units in community}}$$

See page 75 for estimating number of dwellings. This difference between new and old homes is a rough rule-of-thumb but is consistent with household size data in the 1970 U.S. Census of Housing, "Components of Inventory Change, Boston S.M.S.A." Individual communities can check it and readjust it if indicated.

The following is a method to be used if a proposal has a broad range of dwelling types or if the characteristics of future housing are likely to be different from existing housing in the community.

Experience suggests that pupil generation rates vary with the dwelling unit type according to fairly constant ratios. Compared to the number of pupils generated by a typical new single-family unit, a typical townhouse apartment unit or condominium will generate approximately 50% as many pupils, a typical garden apartment about 15% as many, and a typical high-rise unit only about 5% as many. Therefore, if one can determine the pupil generation rate for any one unit type, one can estimate it for all unit types. The generation rate for any unit type can be calculated from existing housing and school data. For example, assume one wants the pupil generation rate for new single-family homes. Call this rate R. The generation rate for townhouses or condominium units is, then, 0.50R, for garden apartment units 0.15R, and for high-rise units 0.05R. Let S equal the number of existing single-family homes in the community, G the number of garden apartment units, T the number of townhouse and condominium units, and H the number of high-

TABLE 4-1
NUMBER OF PUPILS PER UNIT: IMPORTANT FACTORS

Factor	Effect
Age of dwelling	New single-family homes have more children than old single-family homes (children grow up and leave).
	Age has no clear effect on apartment occupant distribution.
Type of dwelling	Single-family homes have more children than apartments (have more bedrooms, appeal to larger families). Apartments have special appeal to retired persons, childless couples, young couples with pre-school children.
Number of bedrooms	The more bedrooms, the more children. This is often the single most important factor.
Specialized type of development	Second homes: no children. Retirement communities, elderly housing, singles complexes: few children. Low-income family housing: more children than average.
Price of unit	Much less important than number of bedrooms. Rutgers study found that: expensive homes and high-rise apartments have more children, expensive garden apartments have fewer.
Characteristics of community	Role of community: e.g., bedroom suburb has more children per unit, college town has fewer.
	Strong parochial schools: may reduce public enrollments.
Year	Large birth-rate fluctuations have led to large differences in pupil generation rates over time: data from the '60's overstates pupil expectations for the '70's.

Source: Herr Associates; Sternlieb and Burchell, "The Numbers Game."

rise units. This data will usually be available from the assessor or building inspector, or can be roughly approximated. The current total school enrollment is then[1]

$$\text{Current Total Enrollment} = (0.67R)S + (0.5R)T + (0.15R)G + (0.05R)H$$

Solving for R:

$$R = \frac{\text{Current Total Enrollment}}{(0.67S + 0.5T + 0.15G + 0.05H)}$$

One can now predict the proposed development's school enrollment:

$$\text{Enrollment From Proposed Development} = R(S' + 0.5T' + 0.15G' + 0.05H')$$

where S', T', G' and H' refer to the number of units of each type expected in the proposed development.

For example, in a community there might be:

14,600 total current enrollment
22,000 single-family homes
0 townhouse units
4,000 garden apartment units
2,000 high-rise units

$$R = \frac{14,600}{0.67(22,000) + 0.5(0) + 0.15(4,000) + 0.05(2,000)}$$

$R = 0.86$ pupils per unit

A mixed development of 200 single-family and 50 townhouse units would produce the following projected enrollments:

Enrollment = $0.86(200 + 0.5 \times 50) = 197$, say 200.

---

[1]The pupil generation rate R for new single-family homes has been multiplied by a correction factor of 0.67 in this equation because existing single-family homes generally have only two-thirds as many pupils as new (proposed) single-family dwellings.

2.1.4 Determine School Cost Per Proposed Dwelling Unit

This is simply the average cost per pupil (from 2.1.2) times the number of pupils per unit (from 2.1.3). For example:

$940 per pupil x 1.2 pupils/unit = $1,130 school cost per unit

Where the proposal includes several types of units (e.g., studios and two-bedrooms; townhouses and garden apartments) estimate the average cost per unit for each type.

2.1.5 Determine Total School Costs for Proposed Development

Multiply the average cost per dwelling unit by the number of units proposed (e.g., $1,130 per unit x 200 units = $226,000 school costs).

Where the development includes several types of units (e.g., studios, 2-bedrooms; single-family and apartments), first estimate the costs for each set of units (e.g., $600 per 1-bedroom unit x 10 1-bedroom units = $6,000; $1,200 per 2-bedroom unit x 20 2-bedroom units = $24,000). Then sum all the costs (e.g., $6,000 + $24,000 = $30,000).

Sample calculations are shown below.

School tax levy	$770,800	
÷ Current enrollment	820	pupils
= Average cost per pupil	$ 940	per pupil
x Est. pupils per proposed dwelling unit	1.2	pupils
= School cost per proposed dwelling unit	$ 1,130	
x Number of proposed units	200	
= SCHOOL COST OF PROPOSED DEVELOPMENT	$230,000	

STEP 2.2A ESTIMATE NON-SCHOOL COSTS FOR RESIDENTIAL DEVELOPMENT

The following method can be used to quickly estimate all non-school costs (police, fire, roads, general government) to service proposed residential development. We assume that each new dwelling will cost the same as the average dwelling in the community.

If a development is strikingly different from others in the community, it may be appropriate to analyze more closely one or two particularly significant items of non-school costs.

2.2A.1 Determine Total Non-School Costs in Community

The community's total non-school cost is its general tax levy (property tax levy less school tax levy). This can be obtained from the assessors.[1]

2.2A.2 Determine Residential Non-School Costs

Only some public services go to residences. One can often assume that the residential share of non-school costs is simply the same as the residential share of property values. Total assessments by category of land use are available from either the local assessors or the Bureau of Local Assessment, Department of Corporations and Taxation. Thus, total residential costs might be estimated:

$$\text{Total Residential Non-School Costs} = \text{General Tax Levy} \times \frac{\text{Residential Assessed Valuation}}{\text{Total Assessed Valuation}}$$

Assessed valuations are not always the best way of splitting costs. If there is a nuclear power plant in the community, it may use a small share of public services but make up a very large share of assessments. Costs can be split instead in relation to each land use's share of the community's developed acreage (from a recent land use survey) or share of employment (State Division of Employment Security) plus population. An item-by-item split of costs can also be made, but the effort is seldom justified by increase in accuracy.

2.2A.3 Estimate Non-School Costs Per Year-Round Dwelling Unit

Divide the total residential costs by the number of dwelling units in the community to find the average cost per dwelling unit.

The total number of dwelling units may be listed in a recent Master Plan or estimated by the regional planning agency. If not, one can use U.S. Census data and building permit records to make an estimate. Find the number of dwelling units for which building permits were issued between the

---

[1] or computed: General Tax Levy = Community Assessed Valuation (in $1,000's) x General Tax Rate. The general tax rate is printed on your tax bill along with the school tax rate and the total (called "actual" elsewhere in this manual) tax rate, which combines the two.

beginning of 1970 or other census year and the year preceding the year whose costs are being analyzed. Building permit information can be obtained from the building inspector or the State Building Code Commission, Massachusetts Department of Community Affairs. Add the number of units authorized since 1970 to the number of units listed in the U.S. Census of Housing, then round off low, to reflect permits issued but not used (sometimes estimated at 5% of the total), plus demolitions.

Another approach is to determine the number of occupied units. If the building inspector keeps tabs on the number of occupancy permits, the number issued since 1970 can be added to the number of occupied units in the 1970 U.S. Census of Housing.

Adjustments are needed if the community now contains a large number of seasonal units.[1]

2.2A.4 Estimate Non-School Costs for Proposed Year-Round Dwellings

Multiply the average non-school cost per year-round dwelling by the number of such units in the development. If the development contains only year-round units, STOP. Sample calculations are shown below.

	General tax levy	$410,000
x	% Residential (e.g., residential total assessed valuation in community	75%
=	Residential non-school costs	$307,500
÷	Number of dwelling units in community	770 units
=	Average cost per year-round dwelling unit	$ 400/unit
x	Number of year-round dwellings in development	200 units
=	NON-SCHOOL COST OF YEAR-ROUND DWELLINGS	$ 80,000

[1] Seasonally-occupied units generally cost less to service. If they cost half as much as year-round units, calculate costs per "equivalent" year-round unit in the community as follows:

$$\text{Non-School Cost Per Year-Round Equivalent Unit} = \frac{\text{Residential Non-School Costs for Community}}{\text{\# of Year-Round Units} + 0.5 \times \text{\# of Seasonal Units}}$$

Seasonally-occupied units aren't listed as such in any regular data source, but can be approximated by adding units listed as "Vacant -- Seasonal and Migratory" and "Vacant -- Held for Occasional Use" in the 1970 U.S. Census of Housing. Remaining units are considered "year-round."

2.2A.5 Adjust for Seasonal Dwellings (If Anticipated)

The following steps can be used to consider seasonal dwellings.

a. Estimate average cost per seasonally-occupied unit. This is probably about half the cost per year-round unit. Occupants may only be in the community a quarter of the year and thus make smaller demands on roads, libraries, sewers. However, they usually add to the peak period demand for which roads and utilities are designed and require some police and fire protection during the rest of the year. If year-round units cost $400 each, we usually assume that seasonal units cost $200 each. If feasible, adjust this fraction up or down depending on local experience.

b. Estimate costs for all anticipated seasonal units. Multiply the average cost by the number of seasonal units proposed.

c. Add costs of seasonal units to costs of year-round units to find the total non-school costs of the development.

STEP 2.2B ESTIMATE NON-SCHOOL COSTS FOR NON-RESIDENTIAL DEVELOPMENTS

Costs of new commercial and industrial development can also be estimated in terms of average unit costs. The non-residential share of the general tax levy can be estimated and then determined per acre, per employee, or per $1,000 valuation. But the results are much less reliable than residential cost estimates, since commercial and industrial development includes such an enormous variety of land uses.

Another approach might be to estimate a range of costs based on the non-school taxes paid by the development. Commercial and industrial uses probably cost no more to service than they pay in such taxes.[1] In fact, they probably cost substantially less. (Some of the services, e.g., libraries and recreation, primarily serve residents.) Some detailed cost studies in Massachusetts have implied that the non-school costs of such uses average about 25% of their non-school revenues (Lincoln), 65% (Ashland), and 60%

[1] Unless they precipitate major public improvements. Note: Even if they only "break even" on non-school costs and revenues, commercial and industrial uses can still be very profitable, since they pay school taxes but have no school costs.

(downtown Boston).[1] Therefore, one might estimate a range of non-school costs:

Non-School Costs = (say .30 to .70) x Assessed Value of New Development x General Tax Rate

Percentages can be adjusted for the type of development. Percentages might be very low for power plants but quite high for downtown shops which add to peak traffic and parking demands and require public police and fire protection.

For major proposals, it may be worthwhile to try to estimate the new development's share of a few large cost items in the community. For example, traffic from a new shopping center might equal 25% of current traffic in the community. It could be roughly assumed that its highway costs would be about 25% of the current highway budget (from annual report, less state aid for highways). This could be done for the largest non-school items in the community (frequently highways, police and fire) to estimate a minimum cost for the development. Total non-school revenues from the development might suggest a maximum figure.

STEP 2.3 ESTIMATE SCHOOL AID IMPACT

State aid for education is designed to reduce fiscal disparities, helping poorer communities more than wealthier ones, with "poor" and "wealthy" being measured by relative amounts of assessed valuation per resident. For that reason, development which brings a relatively large amount of assessed valuation relative to population (such as non-residential development, or luxury housing) may decrease state school aid per pupil for all pupils in the community. Development bringing low assessed values relative to population (such as low-income family housing, or housing taxed under a Ch. 121-A contract) has the opposite effect. The amounts involved can be very substantial, so this step shouldn't be overlooked, as it often is.

Be careful. The following applies to school aid as distributed in Massachusetts in 1978, following a massive change in the state aid formula (as forecast in earlier editions of this manual). More likely than not that formula will be massively changed again at some point in the future, and it certainly doesn't apply in other states. This uncertainty sets a limit on the accuracy of any forecast of long-range fiscal impact; such impact depends upon unstable and unpredictable intergovernmental fiscal relationships.

2.3.1 See if the Community is in the "Save Harmless" Category

The following lists the only municipalities in which development is likely to affect the general school aid reimbursement rate. The remaining 80% of the state's communities are currently under the aid formula's "Save Harmless" provision, which means that future aid is based on a fixed percentage (107%) of pre-1978 aid, and therefore unaffected by subsequent development. To be sure, you can check with the local school department or State Department of Education to see if the community, like most, is in the "Save Harmless" category.

Non-"Save Harmless" Communities, 1978

Acushnet	Clinton	Lynn	Rutland
Adams	Dracut	Malden	Shirley
Amesbury	Dudley	Medford	Somerville
Amherst	East Brookfield	Merrimac	Southbridge
Ashley	Easthampton	Milford	South Hadley
Athol	Fairhaven	Millville	Spencer
Ayer	Fall River	Monson	Springfield
Barre	Fitchburg	Montague	Taunton
Belchertown	Gardner	New Bedford	Templeton
Blackstone	Greenfield	North Adams	Townsend
Boston	Hanson	Northampton	Uxbridge
Brocton	Hardwick	Northbridge	Ware
Brookfield	Holyoke	North Brookfield	Warren
Cambridge	Hudson	Orange	Webster
Charlton	Huntington	Oxford	Winchendon
Chelsea	Lawrence	Phillipston	Winthrop
Cheshire	Leicester	Revere	Whitman
Chicopee	Leominster	Rockland	Worcester
Clarksburg	Lowell	Royalston	

2.3.2 If the Community is "Save Harmless"

If the community is in the "Save Harmless" category (that is, is not on the preceding list), increased enrollments probably won't increase school aid, but the cost per pupil reflected in the cost computed at Step 2.1.5 includes such aid. A fair quick estimate is that state aid not received in such cases equals about 15% of the total school cost calculated at Step 2.1.5. For example, for a community not "Save Harmless" with a school cost of $230,000 calculated at Step 2.1.5, an additional cost to "correct" for school aid not received for those additional pupils is 15% of $230,000, or $35,000.

2.3.3 If the Community is not "Save Harmless"

If the community is not "Save Harmless" (that is, is on the preceding list), more complex analysis may be needed. If the proposed development will add about an average amount of valuation per added resident (e.g., moderate priced houses, or low-cost high-rise housing), the school aid rate impact will be small, and the following can be skipped. In other cases (e.g., expensive single-family housing, seasonal housing, or non-residential development), the effect should be calculated.

2.3.3.1 Calculate Equalized Assessment Valuation Per Capita

Existing assessed valuation and population are listed in The Massachusetts Taxpayer's Foundation's Municipal Financial Data, issued annually.[1] Divide the listed assessed valuation by the "Assessment Ratio" to "equalize" for local assessment practices. For example, Greenfield is listed as having a 1978 assessment (AV) of $132,643,000, assessment ration (AR) of 74%, and 1975 population (P) of 19,087. Baseline local equalized valuation per capita (LEV_B) is:

[1] For communities whose school costs are chiefly those of a regional school district, this whole calculation, both assessed valuation and population, has to be done for the whole region rather than only for the subject municipality.

POLICY PLAN ALTERNATIVES:
GENERATION AND REVIEW

Philip B. Herr
Mary E. Lord
Environmental Impact Assessment Project
Laboratory of Architecture and Planning
Massachusetts Institute of Technology
Cambridge, Massachusetts

July 1978

$$LEV_B = \frac{AV_B}{AR} \times \frac{1}{P_B} = \frac{\$132,643,000}{0.74 \times 19,087}$$

$$= \$9,390 \text{ per capita}$$

Calculate the future local equalized assessed valuation (LEV_F), this time including the proposal. For example, imagine a 100-unit luxury high-rise in Greenfield, with estimated assessed value of $70,000 per unit, or $7,000,000 total, and population of 1.5 persons per unit, or 150 persons:

$$LEV_F = \frac{(\$132,643,000 + \$7,000,000)}{0.74 \times (19,087 + 150)}$$

$$= \$9,810$$

Methods for estimating population of developments are discussed at page 112.

2.3.3.2 Calculate Change in School Aid

Find the amount of school aid the town was expected to receive for the study year ("Base Aid") and the "School Aid Percentage" (SAP), figures available from either the local school department or the state Department of Education, and use them in this unfortunately intimidating equation:

$$\text{Change in School Aid} = \frac{(LEV_B - LEV_F) \times \text{Base Aid}}{\$13,000^* \times \text{SAP}}$$

*This $13,000 figure is the 1978 equalized valuation per capita statewide ($11,100) divided by the 1978 "Local Support Percentage" (0.78), so it will change over time. The change should be slow, however, so this can serve approximation for many years.

For the Greenfield example, "Base Aid" = $1,400,000 and the School Aid Percentage is 0.26:

$$\text{Change in School Aid} = \frac{(\$9,390 - \$9,810) \times \$1,400,000}{\$13,000 \times 0.26}$$

$$= - \$170,000$$

In other words, each dwelling unit in this "fiscally attractive" luxury high-rise development results in loss of $1,700 in school aid, almost certainly enough to wipe out any fiscal gain otherwise developed, which was one of the intents of the aid formula's design.

2.4 ESTIMATE COSTS FOR MAJOR PUBLIC IMPROVEMENTS (where relevant)

Cost estimates made to this point assume that proposed development will have the same average costs (both operating and capital) as existing development in the community. A few proposals, however, impose costs far above the current community average by precipitating certain major public improvements. In these cases, extra debt service due to the development should be counted as an additional cost.[1] The following steps are involved.

---

[1] The school tax levy in Massachusetts reflects past school capital costs. Thus, include new schools as major public improvements only where their incidence is significantly different than in the past.

2.4.1 Determine What Improvements are Involved

First, determine if the development will precipitate any major public improvements. See Chapter 2, "Traffic Impacts," and Chapter 3, "Public Facility Impacts." Check with relevant local agencies, and perhaps with design professionals.

Second, if improvements are required, will they push the proposal's costs far above the current community average? This is likely where the improvements:

-- would not otherwise be built in the foreseeable future;

-- would substantially increase the community's current annual debt service;[1] and

-- would go beyond the type and scale of improvements now being paid for by the community (e.g., a new school in a town which hasn't built a school in 20 years, the establishment of a public sewerage system, etc.).

If the improvement meets all the above, calculate added debt service due to the proposal as follows:

2.4.2 Estimate Municipal Cost of the Improvements

Municipal cost is the total cost less state or federal aid less any contributions by the developer. The specific local agency or design professionals can help estimate costs.

2.4.3 Determine Municipal Cost Due to the Proposal

In some cases, the facility will be utilized primarily by the new development, and costs may appropriately be allocated entirely to it. Usually, however, the facility will be shared by existing as well as new residents, even if it is triggered by new development. What share of the costs might one allocate to the new development? The issue is very complex. One approach is to allocate to the new development only the share of costs needed to meet the demands created by it. Thus, in the case of new school facilities, the

[1] Quickly estimate annual debt service for the improvement (say 10% of the municipal cost estimated in Step 2.4.2). Compare this to the community's current annual principal and interest payments on all improvements. Would the community's debt service increase substantially?

number of pupil-years provided by the school over its expected lifetime can form the basis for the cost allocation.[1]

2.4.4 Calculate Average Year Debt Service Due to the Proposal

The additional principal and interest payments in an average year[2] are computed as follows:

$$\text{Average Year Debt Service} = \frac{\text{Principal}}{\text{Repayment Period}} + \frac{\text{Principal}}{2} \times \text{Interest Rate}$$

(Municipal interest rates now seem to be fluctuating around 6%.)

Note on Bonded Indebtedness. Major public improvements can also affect the community's bonded indebtedness. Will the improvements make it difficult for the municipality (or a public service district) to borrow money for other needed facilities? Local officials who normally deal with bonding and planning capital improvements might:

a. Estimate costs of the required improvements (Steps 2.4.1 and 2.4.2 above).

b. Schedule the improvements.

c. Estimate what the principal and interest payments would be each year; estimate what the outstanding debt would be.

d. Compare these figures with what is already being planned (e.g., in an ongoing capital improvements program).

e. Determine if the total level of borrowing would be likely to impair the community's credit rating and increase interest costs. (Some common suggestions are keeping net debt less than 10% of equalized valuations, and keeping annual debt service less than 15% of the property tax levy.)

STEP 3. CONSIDER SECONDARY IMPACTS OF PROPOSED DEVELOPMENT

These effects are often small and elusive. They are often not worth detailed study. For some proposals, however, indirect costs and revenues are significant and should be included in estimating the tax rate change.

---

[1] See Thomas Muller, Fiscal Impacts of Land Development, op.cit., p. 50.

[2] The average year (when half the principal has been paid off) provides a long-term estimate of the extra costs.

3.1 Nearby Property Values

Effects of a proposal on surrounding property values are hard to predict, may only reflect a transfer in land values from another part of the community, may not show up in re-assessments for years, and in the long run may just promote more intensive development with its own service costs. The effect may be relatively clear and significant in some cases, however. Local officials and merchants might agree, for example, that a department store proposed for a stagnating downtown would stimulate sales of other businesses and push up property values.

Change in tax revenues can be estimated in such a situation:

a. Divide the area around the proposal into a few zones, using a copy of the assessor's map.

b. For each zone, add up the current taxes on all properties (from the assessor's commitment sheets).

c. Multiply the current taxes by a reasonable percentage change for each zone; closer zones will usually show larger changes.

3.2 Spur to Other Development

The likelihood that a major proposal will lead to other development in the community is worth considering. A subsidiary activity, for example, might later be built right by the development, e.g., a gas station next to a shopping center. A major employer in a rural area may increase housing demand by attracting workers to the region; some may settle in the community.[1] A big tax rate drop might attract in-migrants.

In such cases, secondary costs and revenues due to the initial proposal can be estimated:

a. Guess the type and amount of secondary development.

b. Estimate the net impact on costs and revenues

---

[1] Some secondary fiscal impacts are usually not very significant. Shopping centers, for example, have little effect on local housing demand, since they don't usually attract employees from outside the region. Major new employers in metropolitan communities probably have little effect on housing since most workers will probably commute; there may be little in-migration. New housing does lead to retail development, but the stores may be built outside the community and the extra tax revenues may be quite small (often less than $30 per new dwelling).

A lowered tax rate (accruing from a lucrative development) may itself spur additional growth. The additional growth may wipe out or augment earlier fiscal gains. Thus, the full chain of secondary impacts resulting from major development can sometimes be very important.

3.3 Size of Community

As communities grow, their demand for higher service levels, their expenditure levels, and tax rates change. A major residential development can thus have a long-term effect on community costs simply by increasing the population. We roughly estimate that for Massachusetts communities under 50,000, each 1,000 extra people might add a half dollar to the local tax rate. The effect is therefore quite small for most new developments.[1]

Higher tax rates in large communities may reflect added public functions (e.g., public sanitation), the substitution of professional employees (firemen, administrators) for volunteers, and extra layers of administration.

In any event, the most important implications of increased community size may not be on the local tax rate but on the shift in demand among public services, the style and structure of local government, and the opportunities, diversity and social character of the community.

STEP 4. COMPUTE CHANGE IN THE TAX RATE

The difference the development would make in the tax rate if the community maintains its current level of services is estimated as follows:

4.1 Determine Annual Fiscal Gain or Loss

Add up all the direct and indirect costs and revenues from the development. The result is the annual fiscal gain (or loss) due to the proposal.

4.2 Calculate Tax Rate Change

Divide the annual fiscal gain or loss by the combined assessed value of the community and the development.

If this number is positive (revenues greater than costs), it shows how much the tax rate would be reduced. If negative (revenues less than costs), the tax rate would rise by that amount. Table 4-3 shows a format for estimating tax rate change.

---

[1] 1,000 people means about 300 single-family homes or 400 apartments.

TABLE 4-3
SAMPLE FORMAT: TAX RATE CHANGE DUE TO DEVELOPMENT

	Revenues from development	$250,000
-	School costs	- 230,000
-	Non-school costs	- 80,000
±	Change in state aid	+ 40,000
-	Average year debt service for public improvements (if any required)	0
±	Secondary impacts (taxes lost from reduced nearby valuations)	- 10,000
=	Total annual fiscal gain or loss	- 30,000
÷	Assessed value of community plus development (in $1,000's)	34,000
=	ESTIMATED CHANGE IN TAX RATE[a]	$ 0.90 increase

[a]where annual fiscal gain, this is the potential reduction in the tax rate; where annual fiscal loss, this is the potential rise in the tax rate.

For residential developments, it may be valuable to work out a table or chart which shows tax rate change for different kinds of units. Instead of going through the analysis each time a development is proposed, one could look up the result for each proposal's average assessed value and school children per unit. Following is a possible format.

EFFECT OF A 100-UNIT DEVELOPMENT OF THE (1972) BOURNE TAX RATE

Average Assessed Value Per Dwelling Unit	Type of Dwelling			
	Seasonal	Year-Round		
		# of children per unit		
		0	1	2
$10,000	+$0.04	+$0.23	+$0.65	+$1.04
$20,000	- 0.13	+ 0.08	+ 0.47	+ 0.88
$30,000	- 0.26	- 0.07	+ 0.30	+ 0.71
$40,000	- 0.43	- 0.24	+ 0.14	+ 0.54
$50,000	- 0.57	- 0.39	- 0.02	+ 0.38
$60,000	- 0.71	- 0.53	- 0.17	+ 0.22
Assessed valuation per unit needed to "break even"	$12,500	$25,000	$49,000	$74,000

Based on Herr Associates, Guide to the Fiscal Impact of Development, Bourne Planning Board, revised 17 September 1974.

STEP 5. MAKING FISCAL IMPACTS BETTER

Because anticipated fiscal impacts are difficult to accurately forecast and may be transitory, they should rarely be a decisive element by themselves in land use decisionmaking. Preliminary findings of negative fiscal impact can be responded to in several ways. One may find, for example, that the positive social benefit of broadening the mix of housing opportunities outweighs a negative fiscale impact and therefore suggests project approval. Similarly, it may be clear that other projects with positive fiscal benefits will counterbalance those with a fiscal deficit.

A community can consider several actions to mitigate negative fiscal impacts. Among them:

-- The developer can be urged to change his proposed land use mix. He may, perhaps, add or expand nonresidential uses such as commercial or industrial space. The mix of unit types in a residential development may be modified. One should, however, beware of restricting housing opportunities for large families in this approach.

-- The developer can be required to pay the capital costs attributable to him. Issues of allocating costs between old and new development are highlighted in 2.4.3. Also, user charges, as opposed to general property taxes, can be levied to pay for operating expenses of a new development, insuring that those who receive the benefits of services are the same people who pay for them.

Other actions require state authorization:

-- Consideration can be given to changing the local tax structure. Usually, a uniform tax rate applies to all properties regardless of use. However, states can authorize exceptions, as in Montana, where commercial and industrial uses may be taxed at higher rates than residential property. In Massachusetts, communities are empowered to apply lower tax rates only to farmland, forests, and conservation land.

-- Another possibility lies in tax base sharing among neighboring municipalities, an approach that has been successfully implemented in the Minneapolis-St. Paul region. In this approach, the pressure for "fiscal" zoning and its possible exclusionary consequences are reduced because the benefits of non-residential development are spread out among neighboring communities.

CHAPTER 5

ECONOMIC IMPACTS

How proposed development might affect jobs and businesses is the subject of this chapter. Effect on municipal finances is dealt with separately in the chapter on Fiscal Impacts.

Following are general considerations in predicting economic impacts:

Variety of Impacts. The number of new jobs may be the single most dramatic economic impact of a proposal. There are often other significant impacts, however, which should not be overlooked, such as the type of jobs and the effects on existing businesses.

Who is Affected? Will the proposal affect current residents or will it chiefly affect only people who now live elsewhere but may move into or commute to the community? A new high-technology r&d plant, for example, might bring highly-trained, highly-paid professionals into a town, thereby raising the average incomes and skill levels of residents of the town, but leaving the previous residents no better off than before. Effects on current residents and on the overall future of the community may both be important. They are not identical, however, and should be distinguished.

What Happens Under Different Development Outcomes? For example, rejecting a rezoning for a proposed development can have several possible consequences. If the proposed development is designed to serve purely local needs (a small drugstore, professional office building, barber shop), rejecting the development on one site in the community will almost certainly mean that the same jobs, taxes, and activities will instead occur on an alternative site in the same community. Thus, a decision to allow or deny such a development on any given site almost certainly has no economic impact, even though the development involves income, jobs, and taxes.

Other developments are tied not to the community, but to the region. Denied at one location, a major shopping center, a regional insurance office, or an industry drawing on special regional resources will almost certainly be built on an laternative site in the same region, but perhaps not in the same community. Taxes will be lost to the ocmmunity, but jobs and services provided will only be moved, perhaps to a location still well within commuting range of that community's labor force. Decisions to deny such developments certainly have economic impact, though that impact may be only partial.

Finally, there are "foot-loose" activities which are not tied to the region at all: if not developed at a proposed site, all of their economic benefits will possibly be lost. Good examples are major power plants, governmental facilities such as the much-sought solar energy lab, and home offices of national corporations.

Impacts are discussed separately for non-residential and residential development. At the end of the chapter, relationships between the economic impacts of development and the needs of the community are discussed. It is not always obvious whether an impact is good or bad for the community. Each impact must therefore be evaluated with respect to the community's specific goals and concerns.

NON-RESIDENTIAL DEVELOPMENT

New factories, stores, and institutions can affect the local economy in a number of ways. Concerns vary from one community to another, but common questions about proposed non-residential development might include:

Employment

a. How many jobs will be created, including both construction and permanent jobs?

b. Will the firms hire locally or bring workers from other parts of the state or country? Would development substantially increase the number of jobs within commuting range of local residents?

c. What kind of jobs will be created? Do they match skills of local residents? Do they match categories of high unemployment? Do they provide opportunities for skill-building and advancement?

Business Opportunities

a. Would the new development physically displace existing businesses? Will older stores simply relocate into the new facility yielding no net increase in local business activity?

b. Would the new development compete for sales with existing local businesses? Are failures and vacancies likely?

c. Would existing commercial areas be strengthened and supported?

d. Are the new activities likely to buy goods and services from local businesses? Are they likely to provide convenient nearby supplies for

local businesses now reliant upon more distant suppliers?

e. Would the development provide space for local entrepreneurs?

Other Effects

a. Would goods or services be "exported" to other parts of the state or country, brining outside income into the area or would they chiefly be sold to local purchasers? If chiefly to local purchasers, would this be in competition with existing local suppliers, or would it replace purchases now made outside the area and "imported" to it?

b. Would new activities diversify the economy?

c. What would be the effect on nearby property values?

d. Would there be other important indirect effects such as congestion or pollution, or secondary impacts such as stimulating population growth?

These issues are discussed briefly below.

Employment

a. Number of Jobs. The developer may provide an estimate of the number of construction and permanent jobs, or the following rough estimates may be used.

(1) Construction Jobs. Each million dollars of construction may mean about 30 man-years of labor on the site.[1] Man-years are a good general measure, although they are of course split among many craftsmen each working for a short period of time. Construction costs (excluding financing, land, architects) may be obtained from the developer. Table 5-1 shows some rough cost estimates and the number of construction jobs that might be required for each 1,000 square feet of floor space.

(2) Permanent Jobs in a Development. Sometimes the specific businesses that will be locating in the new space are known and the job estimates can be obtained from merchants and managers. Otherwise, it may be possible

---

[1] We assume labor is about 50% of construction costs, a man-year is equivalent to 2,000 hours, and hourly wages range from about $7 to $10 (source: Assoc. of General Contractors). The Boston Redevelopment Authority has assumed slightly more than 30 man-years of employment per million dollars of construction (e.g., 32 for offices, 33 for retailing, 34 for factories). See "Jobs for Boston's Future: Expanding the City's Economic Base Through Capital Investment -- Mayor Kevin White's Program," November 1975.

TABLE 5-1
ESTIMATED CONSTRUCTION JOBS BY BUILDING TYPE

Building Type	Est. 1976 Construction Cost Per Sq.Ft.[a]	Est. Man-Years Per 1,000 Sq.Ft.[b]
Warehouse	$15-20	0.5-0.6
Factory	15-25	0.5-0.8
Shopping Center, Retail Stores	15-25	0.5-0.8
Motel, Hotel	25-35	0.8-1.1
Office		
Low-rise	25-40	0.8-1.2
High-rise	40-55	1.2-1.7
Restaurant	30-45	0.9-1.4
School	30-45	0.9-1.4
Bank	40-50	1.2-1.5
Hospital	55-75	1.7-2.3

[a] Herr Associates estimates based on Means, Building Construction Cost Data, 1975; McGraw-Hill, Dodge Construction System Costs, 1975; and Pasadena & Foothill Chapter, AIA, Preliminary Cost Guide: Complete System for Total Project Development, 1974.

[b] Assumes 30 man-years per million dollars of construction costs.

to predict the type of businesses that will be attracted (adjusting for simple relocations of existing local firms) and to survey the number of jobs which existing businesses of those types provide. Alternatively, a rough estimate may be obtained with Table 5-2 which shows how many square feet there might be per employee. Offices, for example, have about 200 sq.ft. per employee. A 200,000 sq.ft. office building might thus have about 1,000 workers.

(3) Indirect Jobs. New development indirectly creates other jobs elsewhere in the economy as supplies are purchased and workers spend their wages. But these effects are hard to measure and may be small for a local area (purchases tend to "leak out" to other parts of the state or country: steel girders may come from the midwest, lawbooks from Minnesota, a paper mill's pulp from outside the state, etc.). Instead of computing the number of indirect jobs, it may be more appropriate to look for aspects of a development which are especially likely to increase local employment. For example, note if the development (a) is near a shopping center, so workers may stop there on the way home from work; (b) is especially likely to buy supplies from local businesses; or (c) exports goods and services outside the area, thus obtaining outside income.

b. Outside Hiring. Are a large number of the new jobs likely to be filled by workers from outside the region? This may sometimes happen in non-metropolitan or small metropolitan areas where:

-- a major construction contract is involved (e.g., for a power plant, oil refinery, university complex);

-- the firm has highly specialized skill requirements (e.g., if IBM locates in a rural town);

-- the firm will employ an exceptionally large number of people compared to the existing labor supply.[1]

Hiring from outside the region can mean an infusion of new people with new abilities and ideas. It also means that the development offers fewer job opportunities for local residents and, in some cases, might increase

---

[1]The current number of people working or looking for work (the "labor force") may be obtained from the state Division of Employment Security, "Massachusetts Trends in Labor Force, Employment, Unemployment." The labor force is usually about 40% of an area's population. At any point in time, about 5% of an area's population is likely to be seeking new employment.

Table 5-2
SQUARE FEET PER EMPLOYEE

Building	Average	Common Range
office[a]	200 s.f.	150- 225 s.f.
retail[b]	500	250- 750
manufacturing[c]	550	250-1,500
warehouse[d]	800	500-1,500
hotel/motel[e]	7 rooms	

[a] B.R.A. estimates about 210 sq. ft., "Jobs for Boston's Future..."
[b] Sq. ft. gross leasable area. Varies by type of store: low for supermarkets, drugstores; high for furniture and hardware stores. See: Trip Generation by Land Use, Part I, A Summary of Studies Conducted, Maricopa Association of Governments, Arizona, 1974; U.S. Census of Retail Trade, 1972 (Sales per employee); Urban Land Institute, Dollars & Cents of Shopping Centers, 1975 Washington, D.C. (sales per sq. ft.).
[c] Varies widely: low for precision instruments, primary and fabricated metals, apparel, chemicals, rubber, plastics, printing; high for paper, furniture, metal machinery, wood products, stone, clay, glass, concrete. See: Trip Generation; Boston Economic Development and Industrial Commission, "Boston's Industry", 1970.
[d] Source: Trip Generation.
[e] Source: B.R.A., "Jobs for Boston's Future..."

housing demand as outside workers move into the region temporarily or permanently. Some of the new housing might be built in the community, with its own fiscal, social, and economic impacts.

c. Type of Jobs. The community should consider the type of jobs that would be offered. Are they the kind that community residents can or want to apply for? Job needs are different in each community. In some, the key concern may be year-round jobs, in others part-time second jobs would be especially valuable. Relevant job characteristics might include:

-- Wages. Table 5-3 shows average annual wages in different industries.

-- Skills. Table 5-4 shows occupations required for different industries. How does the mix of new jobs compare to the skills and occupations of current residents, especially those now unemployed?[1] Do jobs and skills match? Are the types of new jobs attractive? Are they attainable? Would a job training program be needed or useful? Is one anticipated?

-- Sex. Are jobs likely to go mainly to men or women?[2]

-- Full-time or part-time.

-- Year-round or seasonal.

-- Labor conditions, such as on-the-job training, career ladder, stable employment, unionization.

Because of outside hiring, commuting distances, and mismatches between jobs and skills, only some fraction of the new permanent jobs in a development are likely to go to community residents. The rest will go to workers from other cities and towns (for example, only a third of the jobs in Boston's recent office buildings were filled by Boston residents[3]). It is very difficult to predict who will actually fill the jobs (and who in turn will fill the jobs that the new employees leave behind).

---

[1]The U.S. Census shows the 1970 occupations for all residents and for those who were then unemployed; "Social and Economic Characteristics." For more recent data in Massachusetts, see Massachusetts Division of Employment Security, Employment and Wages by Area Then by Industry, 1975, S-202 file, and Data on the Insured Unemployed.

[2]Also available for each industry from 1970 Census, but conditions are changing.

[3]Boston Redevelopment Authority, "A Demographic Revolution: The Impact of Office Building and Residential Tower Development in Boston," December 1972.

TABLE 5-3
AVERAGE ANNUAL WAGES IN MASSACHUSETTS, 1974

Economic Activity	Average Annual Wage	
Agriculture	$ 7,800	
Mining	12,000	
Construction	12,200	
Manufacturing	10,200	
Ordnance	16,900	
Food	9,800	
Textiles	8,500	
Apparel	6,300	
Furniture	8,300	
Paper	10,400	
Printing	10,000	
Chemicals	12,200	
Petroleum, Coal	13,600	
Rubber, Plastics	9,200	
Leather	7,400	
Stone, Clay, Glass	11,800	
Primary Metal	11,000	
Fabricated Metal	10,400	
Machinery (not electrical)	11,700	
Electrical Equipment	10,600	
Transport Equipment	12,700	
Instruments	11,700	
Transportation, Communications, Utilities	11,200	
Passenger Transit	5,000	(plus tips)
Trucking	11,600	
Air Transport	14,700	
Communications	11,600	
Utilities	13,500	
Wholesale and Retail Trade	7,000	
Wholesale	11,300	
Building Materials, Farm Equipment	9,700	
Department Stores, etc	5,400	
Food	5,800	
Auto dealers, gas stations	8,800	
Apparel	5,600	
Furniture and appliances	7,500	
Restaurant	3,600	(plus tips)
Finance, Insurance, Real Estate	9,700	
Banks	8,900	
Insurance Carriers	10,100	
Real Estate	8,000	

TABLE 5-3 (continued)

Economic Activity	Average Annual Wage
Services	$ 7,900
Hotels, Motels	4,500 (plus tips)
Personal Services	5,300
Business Services	8,200
Auto repair	7,300
Amusements	5,900
Health Care	7,700
Education	9,300
Non-profit organizations	6,000
Other (professional) Services	12,600

Source: Mass. Division of Employment Security, "Employment and Wages in Establishments Subject to the Massachusetts Employment Security Law, State Summary 1974," rounded off to nearest $100.

TABLE 5-4
OCCUPATIONS FOR DIFFERENT INDUSTRIES

Industry	% of Industry Workers in Each Occupation						TOTAL[a]
	Professionals Managers	Clerical Sales	Craftsmen	Operatives	Laborers	Service Workers	
Construction	13	7	57	6	12	1	100
Manufacturing	18	16	18	41	1	1	100
Transport, Communications, Utilities	14	28	21	24	6	3	100
Wholesale Trade	20	44	10	19	5	1	100
Retail Trade	16	41	8	8	4	18	100
Finance, Real Estate, Insurance	21	70	1	--	1	4	100
Business & Professional Services	52	18	5	1	1	20	100
Other Services	14	12	3	11	2	53	100
TOTAL ALL INDUSTRIES	25	26	13	17	3	12	100

[a]does not add due to rounding

Source: U.S. Census, 1970, Detailed Characteristics.

It may be more appropriate to think of a development's jobs as an increase in the employment choices and opportunities accessible to community residents. The number of jobs in a development might be compared with the number of jobs already within commuting range of local residents (perhaps 30-45 minutes):

$$\text{\% Increase in Job Opportunities} = \frac{\text{Jobs in Development}}{\text{Current Employment in Community and Surrounding Towns}}$$

Current employment for each city and town can be obtained from the State Division of Employment Security, "Employment and Wages in Establishments Subject to the Massachusetts Employment Security Law." Coverage by this data is far from complete (government, agriculture, and some other categories are left out) but it may provide a rough basis for the current number of jobs.[1]

Business Opportunities

New development can affect business opportunities in a number of ways.

a. Displacement and Relocation. New development might physically displace existing businesses which might go out of business entirely or relocate in the new development or elsewhere. Some existing stores in an older neighborhood might simply relocate in a new shopping mall. Predictions of new business and employment opportunities from development should be adjusted to account for these displacements and relocations.

b. Competition. Will new commercial development draw a substantial number of customers away from existing community stores? This may not be a major concern where:

-- residents now shop outside the community for items to be sold in the new development. If people now go to a department store miles away, a new department store in town may offer little direct competition to local merchants.

-- new development is relatively small compared to existing commercial development in the town.

---

[1] A new DES publication, Massachusetts Cities and Towns, monthly lists employment tabulated by place of residence, not work; a useful source, but inappropriate for this purpose.

-- substantial population (or income) growth is expected in the area to be served by the new development. Rapid growth can support additional stores without creating vacancies.

Where competition seems serious, careful analysis will be justified. The developer's market analysis may suggest where sales will come from. Another approach is to do the following.

(1) If the development will serve primarily its own town, estimate sales in the new development (from the developer, or, say, $70 per sq.ft. for department stores, $130 per sq.ft. for supermarkets).[1]

(1A) If the development will serve several towns (e.g., a regional shopping center), estimate what share of its sales will come from stores in your community. The fraction depends on existing commercial development in the community compared to other towns to be served by the new development (U.S. Census of Retail Trade indicates 1972 sales for each community).

(2) Compare new development sales (1 or 1A) to current sales for that category of store in the community (U.S. Census of Retail Trade). This suggests the seriousness of potential competition.

c. Existing Commercial Areas. New development in or near existing commercial areas may strengthen those areas. New offices, stores, hotels attract more people to an area. This means more potential customers for existing stores and services, a principle well-illustrated in successful downtowns and regional shopping centers.[2] Important implications:

(1) New stores can have two opposite effects: capturing customers but also inducing potential shoppers to nearby stores. The overall effect may be to shift sales from one part of the community to another.

(2) The exact location and layout of new development may be very important. Does the design encourage or discourage patrons and employees from shopping at existing stores (e.g., by providing one-stop parking, convenient walkways, joint access, etc.)?

---

[1] Per sq.ft. of gross leasable area. Dollars and Cents of Shopping Centers provides estimates of sales per sq.ft. for specific kinds of stores.

[2] Even directly competitive stores often do better when they are close together, offering shoppers a wider array of goods to choose from and therefore attracting more customers to the shopping area relative to other shopping areas.

d. Local Suppliers. Is the new activity likely to purchase supplies from other local firms (e.g., a container company buying from a local paper mill)? Will the new activity sell to local firms more cheaply than presently more remote suppliers? Look for specific arrangements or possible connections with local contractors or merchants. Other general considerations:

(1) Small firms generall use outside services more than large firms (a large company may have its own photocopying, printing, stationery, legal and medical departments);

(2) In terms of the state of Massachusetts as a whole, finance, services, construction, agriculture, and trucking seem to create the greatest additional economic activity. Manufacturing has smaller indirect impacts, since many raw materials come from outside the state.

The impact of these "multiplier effects" can be enormous. For example, because fish processors purchase virtually all their supplies (fish) locally from a labor-intensive industry, each added job in fish processing results in direct and indirect purchases supporting about eight added jobs in the region.[1]

e. Space for Entrepreneurs. Will the development provide spaces for new local businesses? Things to look for:

-- specific arrangements to accommodate local entrepreneurs (e.g., a mall with boots to be rented to local people).

-- spaces suitable for local businesses (such as complexes of small shops or offices) rather than spaces suitable only for major outside firms.

-- any displacement of existing local businesses from the site. Relocation may be a difficult problem, especially for small businesses or those with very specialized site requirements.

Other Effects

a. Export Industries and Import Substitution. Will the new development simply serve existing population (with shops, services, hospitals, schools, ...) or will it sell goods and services to people outside the region? "Export" or "basic" industries earn outside dollars and support population and employment growth. Regional population growth requires "basic" job develop-

---

[1] Herr Associates, "Waterfront Site Productivity," 8 March 1978, for the Gloucester Downtown Development Commission.

ment or else results in more out-commuting or unemployment. ("Taking in each other's laundry" doesn't provide enough jobs for all the region's workers.)[1] Another important related pattern is "import substitution": will new business activities supplant distant firms in selling locally? Reducing local dependence on "foreign" goods aids economic growth.

Export industries include those which:

-- ship goods or provide services to state and national markets. Examples: manufacturing, agriculture, major offices for large organizations (e.g., the I.R.S. in Andover, Mass.).

-- bring outsiders to the region, where they spend money (earned elsewhere) on food, lodging, supplies, etc. Examples: tourism, summer homes, universities, military bases.

b. Diverse Economy. Activities which diversity the region's economy may be especially valuable. Areas now dependent on one or two major export industries may experience severe unemployment if those industries close, move away (as has happened with textiles, shoes, defense contracts) or occasionally have bad years (e.g., construction and tourism). New activities which broaden the region's economy reduce that dependence and may assure greater economic stability.

c. Nearby Property Values. Nearby property values may increase or decrease, depending on the development's social, aesthetic, economic and traffic consequences. Public discussion often focuses on the change in property values. We urge caution in making predictions, however. Effects are sometimes quite complex. Following are some ways to deal with the subject.

(1) Identify impacts which seem clear and large (an unsightly factory will certainly reduce values of nearby residences).

(2) Focus on the area immediately surrounding a major development, where effects are likely to be strongest.

(3) Analyze the source of neighbors' concerns. Neighbors' predictions about property values usually reflect other concerns about the proposal: its appearance, traffic, noise, occupants. Those concerns should be dealt with directly.

---

[1] It is not always easy (or useful) to distinguish export and local service jobs, especially in metropolitan communities. See Hans Blumenfeld, "The Economic Basis of the Metropolis: Critical Remarks on the 'Basic-Nonbasic' Concept," Journal of the American Institute of Planners, 1955.

(4) Recognize the range of possible impacts. Added traffic on a street may decrease the value of nearby residential properties, but increase the value of nearby commercial properties. Less accessible commercial properties may, however, decrease in value. A parcel may become less valuable in its current use (e.g., as a single-family home) but more valuable for a future use (as a gas station, apartment house, etc.). By reducing the supply of vacant land in an area, the development can push up the price of remaining vacant parcels. Very large developments may saturate the local market for that land use and temporarily depress nearby land values. The proposal might pave the way for subsequent intensive development in the area; it may set a precedent for future public decisions, encourage other developers, and precipitate major public facility improvements which would also serve surrounding property and raise property values.

(5) Do not make detailed predictions without consultation with disinterested real estate experts. Lay judgment may well be challenged in terms of reliability and fairness.

d. Other Economic Impacts. Consider other economic impacts which seem significant. For example, new development may have spillover effects such as pollution and congestion, hurting nearby business activity as well as property value. Also, a new firm which greatly increases demand for certain types of workers (e.g., female clerical help, skilled craftsmen, unskilled laborers) can pressure existing firms employing such people to increase wages. Whether and how new workers will be unionized affects existing unions in the community. Outside workers who will move into the community have their own economic impacts (see Residential Development below).

RESIDENTIAL DEVELOPMENT

Residential development also has economic impacts, although these are sometimes less visible than effects of new stores and factories.

Construction Jobs

New residential development creates construction jobs. Each dwelling unit involves about one man-year of on-site construction labor.[1]

[1] Source: Massachusetts Association of Homebuilders.

Second Homes as an Export Industry

Second (and retirement) homes are really an "export" or "basic" industry. Occupants have earned money elsewhere, which they spend in the region for food, doctors, gasoline, property taxes, etc. This supports new jobs in the community and region. As a rough guess, we estimate that each second home supports 0.15 year-round jobs[1] (perhaps twice as many jobs during the peak season).

Retailing in the Community

New residents will support additional store sales in the community and surrounding towns. In 1972, the average Massachusetts resident spent about $2,300 in supermarkets, gas stations, department stores, restaurants, and other retail establishments.[2]

Thus, 1,000 new residents might generate between $2,000,000 and $3,000,000 in retail sales. (Higher income residents more, lower income less; seasonal residents perhaps a fifth as much as year-round residents.) This would increase sales in existing stores and might support another 30,000 to 50,000 sq.ft. of retail space (assuming annual sales of $60 to $70 per sq.ft.).

How is this likely to affect local retailing? Some but not all of the new sales would occur in the community. The community's share depends on how its commercial facilities compare with those of surrounding towns in terms of scale, variety, relative distance from the development, and room for expansion. For example, if the community contains a wide array of shops and is the dominant commercial center in its region, it may capture a very large share of new residents' purchases. A small community with a few local convenience stores might initially only attract a small share of purchases. But as it grows, new retail sales will generally grow at an even faster rate because of the broader variety of available goods and increased convenience

---

[1] Herr Associates, "Social and Economic Impact, the Crumpin-Fox Development, Bernardston, Mass.," prepared for the Franklin County Planning Department, 1972. We have found roughly similar results on Cape Cod.

[2] U.S. Census of Retail Trade.

[3] An elaborate method for estimating local sales is described in Daryl Hellman, "External Impacts of Housing Developments, Calculating Effects on Commercial Property Values," Urban Land, October 1974.

within the community.

In the long run, major new residential development may therefore create substantial pressures for new commercial development within the community. Approving large residential proposals may thus have long-range effects on commercial growth and commercial zoning in other parts of the community.

Employment in the Community

Large residential developments attract new residents (and potential workers) into the community. Such a development could affect community and regional employment, and unemployment, in a number of ways (this doesn't apply to second or retirement homes which don't add new workers):

a. Labor Force. New residents mean more people holding, or looking for, jobs in the community. There are normally about 40 job-seekers for every 100 residents.

b. Service Jobs. Residents will support additional jobs in retailing, medical care, government and other services. Many of the service jobs may occur in nearby towns, as suggested in the discussion of retail sales. In a small, rural town, 1,000 new residents might lead to 50 service jobs in the community; in a large town or city with major commercial development, 1,000 new residents might create 150 jobs within the community.[1]

c. Export Jobs. Residential development, unless for the retired or for seasonal occupancy, adds more job seekers than support for service jobs. Balance in achieved through added "export jobs," or by commuting outside the community (or in the short run by increased unemployment or by vacant housing units). It is useful to at least approximate how much of each of those is a likely consequence. Each 1,000 new residents means 200-350 new "export" jobs must be provided if net outcommuting is not to grow.[2]

---

[1] We roughly estimate that 1,000 new residents support 150-200 new service jobs in the region. The ratio depends on the size of the region, income of residents, and how one distinguishes "local service" jobs from total employment. See Franklin County Planning Dept. and Herr Associates, "State of the Economy: 1975, Franklin County, Massachusetts"; and Edward Ullman, Michael Dacey, Harold Brodsky, The Economic Base of American Cities, Seattle: Univ. of Washington Center for Urban and Regional Research, rev. 1971.

[2] The Office of State Planning has compiled 1970 U.S. Census data on the number of jobs and total labor force in each community (their data also shows commuting to and from every other city and town). The State Division of Employment Security lists current labor force and covered employment in each community, providing a more recent picture of net commuting.

IMPACT EVALUATION

Several first-cut approaches for predicting how development outcomes might impact employment and business activity have been outlined. Evaluation of the goodness or badness of these impacts requires judgment. What relation do they bear to the community's particular needs and resources? A few issues among many are highlighted below.

a. Growth in Number of Jobs. More jobs may be good or may be bad. Low-skilled or seasonal jobs may be desirable in some places, undesirable elsewhere. Needs have already been identified in many communities by Overall Economic Development Programs (OEDP's), master plans, industrial development agencies, regional planning agencies, or local business groups. Such plans and organizations can be very valuable in evaluating new development.

Communities with high unemployment or underemployment may seek job expansion that will match the skills of residents. Some communities seek job expansion to improve their fiscal structure, attracting "tax ratables" such as industry and commercial activities. Other communities may intentionally shun job growth, wishing to preserve their small-town image.

b. Diversification of Job Types. Diversification can sometimes improve job stability in a community, buffering it against the effects of cyclical unemployment. Herr, too, it is difficult to generalize about the desirability of diversification. A tourist town, for example, deriving its image from that one industry, may choose to risk periodic bad times in order to maintain its character.

c. Community Balance Between People and Jobs. Population growth from residential development adds to the labor force but does not itself support a sufficient number of new service jobs to meet its job needs. Thus, if basic job growth doesn't keep pace, increased out-commuting to other towns will occur. The community must judge if this is good or bad. Stable commuting patterns of specialized bedroom communities may be quite acceptable. On the other hand, increased out-commuting, even if not critical economically, does affect people's time and energy, the social character of the community, and the local tax rate. High levels of traffic may pass through some communities on the way to jobs in other towns or the central city. A community may wish to intercept some of this traffic and reduce congestion by expanding its own job opportunities.[1]

---

[1]See Thomas Muller, Economic Impacts of Land Development, Washington, D.C.: Urban Institute, 1976, p. 12.

Should a better balance between people and jobs in a community be sought, the number of jobs needed can be compared with likely growth in basic industries. For reference, covered employment figures from the Division of Employment Security let you quickly identify past job growth in manufacturing; past growth in tourism, government, and other basic industries is much harder to determine.

SUMMARY CHECKLIST

	Impact Prediction	Impact Assessment
NON-RESIDENTIAL DEVELOPMENT 1. Employment -- no. of construction job opportunities -- no. of permanent job opportunities -- hiring of locals vs. others; commuting times -- job types and match with community skills and unemployment		
2. Business Opportunities -- displacement of existing businesses -- competition with existing businesses -- strengthening existing commercial businesses -- local buying and selling -- provision of space for entrepreneurs		
3. Other Effects -- export of goods; import substitution -- diversification -- pollution; congestion; inducement of population growth		
RESIDENTIAL DEVELOPMENT 1. Number of construction job opportunities		
2. Second homes as import industry		
3. Impact on retail sales in community		
4. Employment -- no. of job seekers -- no. of service jobs supported by population -- no. of export jobs for "balance"		

CHAPTER 6

SOCIAL IMPACTS

INTRODUCTION

Social impacts of development decisions are often very important to community residents but are not often explicitly dealt with in impact analyses. This chapter outlines how new development may affect community character by changing the type and number of residents, the adequacy of their housing, the style and structure of local government, and community amenities. Other social impacts are not considered in this chapter because they are discussed in other chapters (e.g., social consequences of traffic and jobs, visual qualities, and perceived image of the community) or are very hard to evaluate (e.g., effects on sociability, privacy, security, crime[1]).

Social issues are often ignored in impact studies because they are hard to quantify, touch on strong political and emotional feelings, raise sensitive legal issues, are clouded by misconceptions, and may not by themselves provide sufficient grounds for public decision. Despite these difficulties it is still valuable to consider social impacts since:

-- Social impacts may be residents' major concerns about proposed development, although official debate centers on, say, fiscal or traffic impacts;

-- Failure to bring these concerns out in the open makes it harder to resolve conflicts;

-- Analysis can suggest ways in which the proposal could be changed so that its social impacts would be more beneficial;

-- Discussion can help prepare the community for impending change, easing the transition if a major development is built.

---

[1] For discussion of such issues, see Schaenman and Muller, Measuring Impacts of Land Development. Be skeptical of easy conclusions on these impacts; people often have strong prejudices. For additional discussion of such issues as recreational patterns, shopping opportunities, pedestrian mobility, and personal safety and privacy, also see Kathleen Christensen, Social Impacts of Land Development, Urban Institute, Washington, D.C., 1976.

Public Discussion

It is useful to provide an organized opportunity for discussing social concerns, first thinking through the likely consequences of a proposal, and then evaluating them as objectively as possible, suggesting which hopes or fears may be reasonable and which may be unwarranted. Finally, appropriate actions by the community and the developer would be determined. A relatively simple approach is often best, involving:

1. Early citizen input to identify the most critical concerns (see page 8);

2. Reference to community needs and resources which have already been identified and detailed by a Master Plan; by response (in Massachusetts) to the State Growth Policy Questionnaire; by specific local agencies such as a Town Government Study Committee, Historic District Commission, Housing Authority; by the regional planning agency and State Department of Community Affairs; and by other organizations such as a housing action group or civic association;

3. In some cases, review of similar developments which have been built in the community or region;

4. In a limited number of cases, conducting surveys of citizen attitudes and perceptions, although these are often costly, time-consuming, and can easily produce distorted results.[1]

General Assessment Issues

Following are some important considerations in evaluating social impacts.

Value Judgments. Many social impacts may be either good or bad, depending on one's point of view. A more diverse population, for example, may be valued by some, feared by others. Analysis should first try to make clear the extent of change due to a new development (often less change than sup-

[1] Some investigators place considerable emphasis on surveys. For example, people living near apartments have been surveyed to determine social interactions, feelings towards new residents, and changes in their activity patterns. See New Jersey County and Municipal Government Study Commission, Housing & Suburbs: Fiscal and Social Impact of Multi-Family Development, October 1974; Philip Schaenman and Thomas Muller, Measuring Impacts of Land Development, Urban Institute, 1974; Kathleen Christensen, Social Impacts of Land Development, op.cit.

porters or opponents had assumed). Then, citizens and officials can evaluate whether that change is positive or negative, and consider ways to improve negative impacts.

Area Affected. Consider impacts on both the entire community (e.g., housing supply, form of government) and the immediate neighborhood. Proposals can dramatically affect neighborhood charcter, but have little effect on the rest of the community. New development often has the greatest impact on current residents who live within earshot or view, live on streets providing access to the development, or will use the same shops, parks, or schools as occupants of the new development.

Will Change Happen Anyway? Many communities don't want to change. Major development proposals highlight change and are often blamed for all the effects of growth on a community. Some growth and change may be inevitable, however, whether or not the development in question is approved. In retrospect, for example, few individual residential developments have by themselves increased community population above what it would otherwise have been, since population is usually determined by more basic social and economic forces. Therefore:

1. Consider likely changes in the community's social character if the proposal is rejected (through other new developments on and off the site, turnover of residents in existing units, etc.);

2. Determine what difference a decision to approve a proposal is likely to have compared to a decision not to approve it. Use a consistent time frame for the comparison; compare what the community might be like in, say, ten years' time if the proposal is approved with what it might be like in ten years in the proposal is not approved -- don't compare it with what the community is like today.

Frequently, attention should focus not on growth per se, but on the particular location, design, and timing of that growth. Consideration of these issues will also help suggest ways to mitigate negative impacts.

Assimilation. Will it be easy to assimilate new development into the community? This is often the fundamental question. The answer greatly depends on the proposed development's:

1. Scale, compared to existing development nearby; small projects are usually less disruptive visually and socially;

2. Phasing; slower growth is less disruptive;

3. Balance; a project with both single-family homes and apartments produces less dramatic change on a single-family neighborhood than an all-apartment project would;

4. Separation from the community; sometimes buffers are used to separate a project from its neighbors, but often people are more concerned that two separate communities might be created. Social segregation between the proposal and neighbors can be reduced by: (a) building the development in small components (e.g., extending, not interrupting, the existing street pattern); (b) marketing the development so that it will include some old community residents (not only newcomers); (c) providing facilities (e.g., playgrounds) which will be used jointly by project residents and the general public.

Outlined below are potential social impacts on population, housing, local government style and structure, and community amenities.

POPULATION

Development affects the number and type of people who live, work, shop in or visit the community. New dwellings have the greatest impact and are discussed below. Population impacts may also be important in other situations, however. Some proposals would displace existing residents from the site (perhaps forcing them to move out of the community). Major factories and other new employers may increase local housing demand, indirectly increasing population. College dormitories, hospitals, nursing homes and other live-in institutions have many of the same population characteristics as residences. Hotels, guest houses and campgrounds also increase population, at least temporarily.[1] Finally, some non-residential facilities can

---

[1]Some communities recognize these similarities in their regulations. The following is from the Greenfield, Mass., zoning bylaw:

> "Each two guest units in a motel or hotel, four beds in a hospital, nursing home, or convalescent home, or accommodations for four persons in a boarding or guest house or dormitory or other group living arrangement shall be considered equivalent to a dwelling unit in calculating required lot area."

result in tremendous but sporadic influxes of population. For example, sports and exhibition arenas, entertainment centers, and recreation facilities can attract large numbers of people for short periods of time, placing tremendous burdens on an area's services and facilities, and on the tranquility of its inhabitants.

Several factors should be considered in evaluating population impacts of new residences.

Number of Residents

a. Estimate for a Specific Development. The population which a development will initially contain is easily approximated:

Number of single-family dwellings x 4.0 = single-family residents

Number of seasonally-occupied single-family dwellings x 5.0 = seasonal residents

Number of multi-family units x 2.5 = multi-family residents

Number of units reserved for the elderly x 1.5 = residents of housing for elderly

Table 6-1 provides some additional refinements.[1]

To get a sense of scale, compare the population contained in the proposed development with the community's total population increase during the last decade (e.g., 1975 state census minus 1965 state census; never mix U.S. and state census figures since they define residence in different ways).

The hard but important question whether proposal population represents a net increase over what would otherwise occur in the community. Is there some reason to believe that this proposal can, by itself, substantially alter the community's future population? Will the project serve a hitherto untapped market through unique design or marketing strategy? Does this development have some special advantage others have lacked, such as better financing, an extraordinary site, or a special regulatory exemption? Unless

---

[1] Alternatively, one can use data on size of household from the 1970 U.S. Census, General Population Characteristics. Increase the persons per household reported there for the community by 1 person per unit for single-family dwellings, since new homes usually have more people than average.

TABLE 6-1

PERSONS PER NEW UNIT

	No. of Bedrooms	Rutgers Study	Common Range[a]
High-rise apartment	average	2.0	1.2 - 2.5
	0 (studio)	1.2	
	1	1.8	
	2	2.5	
Garden apartment	average	2.2	1.8 - 3.0
	1	1.9	
	2	2.8	
Townhouse	average	3.1	2.7 - 4.0
	2	2.7	
	3	3.4	
	4	3.7	
Single-family home	average	3.5	3.2 - 4.5
	3	3.3	
	4	3.7	
Seasonal dwelling			4.1 - 6.1[b]
Hotel, motel room			2
Campsite			4

[a]May be lower for retirement dwellings, higher for subsidized units.

[b]Within range, high for Cape, Islands and Berkshires, low elsewhere.

Sources: Sternlieb and Burchell, "The Numbers Game: Forecasting Household Size," Urban Land, January 1974 (Rutgers Study); Herr Associates estimates.

some answers are "yes," it is unlikely that the proposal would substantially increase the community's future population above what it would otherwise be (as a result of development on other sites).

One can also estimate proposal population over time. The number of people in each single-family home usually decreases over time (children grow up and move away).[1] Apartments do not lose population, perhaps even increase in population slightly over time. Seasonally-occupied units may be converted to year-round use (a rule-of-thumb is that about 10% of such units are converted each year).

b. Estimate for Rezoning an Area. Population consequences of rezoning are estimated differently.

1. Calculate the theoretical saturation population in the area to be rezoned for both present and proposed zoning: total available land in the area to be rezoned (excluding developed and undevelopable land) minus 15% for streets and waste, divided by the required lot area per dwelling unit equals the saturation number of dwelling units; multiplying that by population per dwelling unit gives saturation population.

$$\frac{.85 \times (\text{available developable land})}{\text{Lot area per dwelling unit}} \times \text{persons per dwelling unit} = \text{Saturation Population}$$

2. Estimate the probability of development actually occurring by whatever time horizon you choose. For example, current zoning may require 10,000 square foot lots, and the land is under pressure for development, giving something like a 90% probability of development within ten years. Rezoning to 40,000 square foot lots might reduce the probability of development within that time period precipitously, say to 50%.

3. Multiply the saturation population by the probability of development for both present and proposed zoning to get the expected populations at the time horizon.

To illustrate, suppose 1,000 buildable acres are proposed for rezoning from 10,000 sq.ft. single-family lots to 20,000 sq.ft. lots.

---

[1] In 1970 in the Boston Metropolitan Area (excluding Boston itself) single-family dwellings less than 10 years old averaged 4.1 persons per unit, those more than 10 years old averaged 3.0 persons per unit.

$$\frac{0.85 \times (1{,}000 \text{ acres} \times 43{,}560 \text{ sq.ft./acre})}{10{,}000 \text{ sq.ft. per dwelling unit}} \times 4.0 \text{ persons per dwelling unit} =$$

14,800 persons at saturation under present zoning.

$$\frac{0.85 \ (1{,}000 \text{ acres} \times 43{,}560 \text{ sq.ft./acre})}{20{,}000 \text{ sq.ft. per dwelling unit}} \times 4.0 \text{ persons per dwelling unit} =$$

7,400 persons at saturation under proposed zoning.

Probability of development within ten years under current zoning is judged to be 0.8.

0.8 x 14,000 = 12,000 "expected" ten year population, current zoning.

Probability of development within ten years under proposed zoning is judged to be 0.5.

0.5 x 7,400 = 4,000 "expected" ten year population, proposed zoning.

Impact = 12,000 - 4,000 = 8,000 persons reduction.

Growth Rate

Often the rate of population growth has a greater impact on the community than has the absolute amount of change. There is a tremendous difference in impact if several hundred new residences are built and occupied in a one- or two-year period than if the same number of units are developed over a decade. If, as is too often the case, the community is unprepared, sudden change may create severe disruptions in normal activity patterns, place severe strains on facilities and services, and make the processes of adjustment much more difficult. Generally, as the rate of growth increases the pace of change of all types will increase.

Growth rate for residential projects can be analyzed as follows:

a. Get an estimate from the developer of the anticipated rate of occupancy of lots or units.

b. Test that against "reasonable" expectations. Considerations might include the following:

-- Is there or can there be a limit on occupancy rate imposed under zoning? If so, that establishes an upper limit of expectation.

-- Is the anticipated number of units per year large in relation to the average town-wide total number of dwelling units authorized on building permits in recent years (data available from the Building Inspector, annual reports, or the State Building Code Commission in the Massachusetts Department of Community Affairs). If it is, is there some reason to believe that this proposal will, by itself, alter the town's rate of growth (see page 115)?

-- Is the anticipated number of units per year small in relation to the total number approved? Again, a warning flag should be raised, since most developers will try to move their entire development as rapidly as the market allows. Is the anticipated development rate as high as the market or regulation will allow? If not, then the anticipation isn't normally credible.

Some communities are now regulating growth rate by requiring that certain projects be phased over a period of several years. This can help ease community change due to the proposal. Greenfield, Bourne, Tisbury and Hanover are examples in Massachusetts.

Population Origin

Where will new residents come from? If most of the residents of new housing now live in the community or in its vicinity, the degree of social change is likely to be much less than if residents are strangers to the area. To estimate place of origin:

a. Ask the developer. For projects of any size, he should have made analyses of expectations, and they're probably as good a projection as can be made.

b. Compare the housing being offered to local housing needs. Any of the following probably indicate the likelihood of many newcomers:

-- A large number of units per year in relation to previous town-wide rates of development;

-- Units with costs higher or lower than the norm in the community;

-- Multi-family units in a predominantly single-family community.

Population Composition

Who will the development serve? This is often the most sensitive but least openly discussed issue in the whole range of possible development im-

pacts. The questions "who will live here?" and "will they be like us?" are often on many minds but rarely get asked in public. This subject is fraught with misconceptions. A New Jersey study comparing prevailing community attitudes about apartment dwellers (e.g., their income, education, employment, and political leanings) found that the preconceived notions differed dramatically from the actual characteristics.[1] A survey in Burlington revealed that people in single-family neighborhoods abutting apartment developments typically had a more favorable attitude toward apartments and their inhabitants than did community residents generally.

Key factors in considering population composition may include race/ethnicity, income, occupation, age, tenure and stability of new residents. The service demands, activity patterns, and lifestyles of the residents will be far different if the tenants of, say, a garden apartment complex are primarily elderly than if they are college students. Another important consideration is the number of children in the development.[2] This has important social, as well as fiscal, consequences. It is often through their children that adults meet and get to know one another. Children also mean more neighborhood activity and noise.

Single-family homes usually have larger households and more children than multi-family units. However, these differences may be diminishing[3] as the increasing price of single-family homes places them beyond the reach of many households.

Table 6-2 compares household characteristics for relatively new and older units in the Boston region (excluding Boston itself) in 1970. Such differences in occupants between new and old units can still generally be expected, although the actual numbers have of course changed, and although there are many local exceptions to the general pattern.

In general, occupants of new housing tend to be better educated, wealthier, and live in more expensive units than occupants of older housing. The

---

[1] State of New Jersey County & Municipal Government Study Commission, Housing and Suburbs: Fiscal and Social Impact of Multi-Family Development, 1974.

[2] See page 71 for estimating the number of children in a new development.

[3] New Jersey, Housing and Suburbs, op.cit.

occupants of new single-family homes also tend to be younger and dominantly in their middle years. Occupants of new multi-family units tend to be either young or old, not middle-aged, and relatively little different in age from occupants of older multi-family units. Used with judgment, these comparisons can help in estimating likely differences between occupants of proposed units and the rest of the community population.

Compare likely population characteristics of the proposed development with recent trends. Information on the community's current population characteristics may be obtained from local and regional planning studies, housing interest groups, and area realtors.

For a new development, one can estimate characteristics of future residents based on (a) surveys of similar recent developments, (b) rough guides, such as Table 6-2, (c) the developer's marketing plans, and (d) the proposed price or rent levels, from which one can infer income of the occupants. For single-family homes, annual family income is often about 40% of the selling price. Family income may be about 4 times the annual rent in subsidized apartments, 5 to 8 times the rent in medium-priced units, and 10 times the rent in luxury units.

HOUSING IMPACTS

When considering housing impacts, two basic questions should be addressed. First, how will the proposal affect the range of housing choice in the community? Second, what will be the implications for critical housing needs of people who presently lack adequate housing? Community housing information is usually well-documented. Sources of information include local and regional planning studies, the 1970 U.S. Census of Housing, local housing authorities, local realtors, and housing interest groups. Any community which has applied for a Community Development Block Grant (from HUD) should have prepared a Housing Assistance Plan including a variety of information useful in thinking about local housing issues.

Housing Supply

Development can affect housing choice in a number of ways. Does the proposal:

TABLE 6-2
POPULATION CHARACTERISTICS, NEW AND OLD DWELLINGS
(BOSTON SMSA BUT NOT IN BOSTON CITY, 1970)

	New Units[a]	Old Units[b]
Persons per owner-occupied unit	4.1	3.0
Persons per renter-occupied unit	1.8	2.3
Households with children under 18	52%	42%
Years of school completed		
Owner-occupied	13.4	12.7
Renter-occupied	12.8	12.4
Income		
Owner-occupied	$15,000	$12,400
Renter-occupied	$ 8,700	$ 7,500
House value	$31,600	$24,500
Gross rent	$ 178	$ 136
Age of household head, all units		
Under 25	5%	5%
25-29	14%	9%
30-34	14%	9%
35-44	31%	21%
45-64	30%	42%
65+	6%	14%
Age of household head, owner-occupied		
Under 25	1%	1%
25-29	9%	5%
30-34	15%	8%
35-44	39%	23%
45-64	33%	47%
65+	3%	16%
Age of household head, renter-occupied		
Under 25	16%	15%
25-29	28%	19%
30-34	11%	10%
35-44	10%	16%
45-64	22%	30%
65+	13%	1%

[a]Units added by construction during the sixties.

[b]Units existing in 1960.

Source: Computed from Table 2, 1970 Census of Housing, Components of Inventory Change, Boston SMSA, Final Report HC(4)-3.

a. Broaden the mix of housing in the community (e.g., single-family and multi-family, year-round and seasonal, owner- and renter-occupied)? The 1970 U.S. Census of Housing has information on existing housing for most communities.

b. Broaden the price range of housing in the community? Note, however, that units priced beyond the means of current residents will serve outsiders.

c. Involve demolition of housing on the site?

d. Lead to demolition of housing nearby? A shopping center, for example, may induce conversion of nearby residential properties to commercial use.

e. Increase demand for existing housing, so that current residents are displaced by higher-income people? This is sometimes an indirect effect of major employers, universities, luxury housing, and recreational facilities.

It is also useful to ask if the proposal is similar, in price and amenities, to other housing in the community or nearby communities. If similar housing has a high vacancy rate, the proposal (1) probably doesn't have an important impact on local housing choice, and (2) may reduce the value of existing housing through over-building.

Housing Need

How will the proposal affect current residents who live in substandard housing or pay a disproportionate share of their income for rent?[1] New development can affect housing needs in several ways:

a. By displacing low and moderate-income families (especially large families) and elderly residents, who may have few alternatives in the local housing market unless adequate relocation is provided.

b. By providing low-cost housing for low and moderate-income people. With rising housing costs, new low-cost housing may only mean mobile homes

---

[1] Massachusetts Department of Community Affairs has estimated the number of people in substandard housing and those paying more than 25% of their income for rent in each community. See Table 7 of the D.C.A. Housing Needs Study. Compare their estimate with other local housing data.

or subsidized units.[1] Information concerning (1) whether or not any units will be subsidized, (2) how the anticipated prices/rents compare to what people living in the community can afford, and (3) the number of bedrooms (i.e., can large families be accommodated) will be helpful in determining whether a development will help meet the needs of low and moderate income people.

c. By affecting the community's status under the Chapter 774 "anti-snob zoning" program. New subsidized development may exempt the community from state override of local regulations.[2] Projects approved the the community may thus prevent less sensitive development over which the community would not have a final say.

The community's overall land use policy can facilitate provision of low-moderate income housing in new developments. First, it can insure that sufficient land is available for multi-family housing, either explicitly zoning land for that use, or allowing that use through special permit or other flexible devices on an ample number of sites, or through special purpose land banking. Second, it can remove cost-creating restrictions in its zoning and subdivision regulations such as excessive floor area requirements or demands for granite curbing, etc. Third, it can publicize a policy welcoming its fair share of low-middle income housing and outlining the steps for obtaining approval for such proposals. If the need is great, it can go further. The public action of granting a variance, or rezoning land from single-family to multi-family use often bestows financial benefits to developers. In return for such a land use change, a community might mandate that a minimum percent of units be provided for low-moderate income families. Incentives such as density bonuses or other relaxations of regulatory standards can also stimulate developers to provide a broader housing mix for all income groups.

---

[1] Subsidized housing may include public housing constructed by a local housing authority with subsidies from D.C.A., a mixed-income development under the Massachusetts Housing Finance Agency, or subsidized rents in some or all units of an apartment complex (through Federal "Section 8" assistance).

[2] Provisions are complex (Sections 21-23, Ch. 40B, Mass. Gen. Laws), but the State Housing Appeals Board can generally overturn a local rejection of subsidized housing if less than 10% of the community's existing housing supply is subsidized.

LOCAL GOVERNMENT

As communities grow, so too do their governments. Local government growth often means changes in structure, style of operations, range of governmental services, and costs.[1] Only rarely will a single development force a change in the structure of local government. The cumulative effects of several developments may be significant, however. Increased population may eventually lead to:

a. A shift from open to representative town meeting. Communities over 15,000 population are likely to have representative government (Table 6-3). Note, however, that local preferences can delay that change: three Massachusetts towns over 30,000 population still have open town meetings.

b. A shift from part-time lay administrators to full-time professionals (executive assistants, town and city managers). The majority of communities over 20,000 population have professional administrators (Table 6-3).

c. Increased bureaucracy. As government organizations grow they become more formal and compartmentalized. Citizens have less access to officials. It becomes harder for people to sit down together and work out problems informally on a first name basis.

d. Public provisions of services which could not have been supported in a smaller community, such as public sewerage, solid waste collection, major libraries, swimming pools, tennis courts, skating rinks.

e. Transfer of political power from "oldtimers" to "newcomers." New residents are often very politically active and involved in local government.[2] New residents may have different values and different preferences for local spending.

AMENITIES

New development can affect community amenities in a number of ways. Look for the following:

a. Provision of On-Site Services and Facilities for the General Public. A shopping center may greatly increase the variety of stores easily accessi-

---

[1] See "Fiscal Impacts," page 63.

[2] New Jersey, Housing and Suburbs, op.cit.

TABLE 6-3

GOVERNMENT STRUCTURE 1975

Population 1975	Number of Municipalities	% of municipalities with: Open TM[a]	Rep TM[a]	Council[b]	% of municipalities with: Manager or Exec. Assistant
0- 5,000	141	100	0	0	6
5-10,000	63	95	3	2	22
10-15,000	44	89	11	0	32
15-20,000	29	55	31	14	45
20-25,000	15	33	60	7	73
25-30,000	15	13	67	20	73
30-35,000	11	18	37	45	55
35-40,000	8	12	25	63	25
40-60,000	12	0	25	75	17

[a]TM = Town Meeting

[b]Council = City or Town Council

Sources: Massachusetts 1975 State Census; Massachusetts League of Cities and Towns, Municipal Directory, 1975-1976.

ble to local residents. Proposals involving entertainment, recreation, restaurants, professional services, specialty shops, hospitals can make a community a more convenient and rewarding place to live.

Some residential developments also provide amenities for the general public, such as golf courses, ski facilities, meeting halls, trails, and preserved open space. Density bonuses can be granted to reward and encourage such amenities.[1]

b. Indirect Demand for Facilities, Services and Organizations. As a community grows it becomes able to support a much wider variety of activities. New development (residences, universities, etc.) may increase local population enough to support specialized shops, services, religious, social and fraternal organizations. New development may also support new public services and facilities such as new libraries and recreational facilities.

c. Effect on Existing Amenities. Proposed development may be located in the vicinity of (or atop) cherished community assets: woods, wetlands, meadows, cliffs, historic buildings and areas,[2] a cherished mini-park or country store. These amenities may be an important element in the character of the community. Loss or damage to them can be an important cost of new development. Pedestrian or vehicular access to amenities may also be disrupted. Change in or loss of routes that residents have been long accustomed to and may even cherish should be recognized as costs. Note, however, that such areas or paths might be threatened by development even if the proposal in question is turned down.

Sensitive design is often the key for dealing with such areas. Cluster development, for example, may allow natural features to be preserved for open space. The alternative may be a large-lot subdivision covering the entire site and destroying all its natural features. (See Chapter 7, "Visual Impacts.")

---

[1] See the new Massachusetts Zoning Act, Chapter 40A, Section 9.

[2] Valuable natural areas are often identified in local conservation plans. Some historic buildings, sites, and landmarks have been identified by the National Register of Historic Places, local and regional historic commissions, the Massachusetts Historical Commission, and private organizations such as the Trustees of Reservations.

CHAPTER 7

VISUAL IMPACTS

INTRODUCTION

What Are Visual Impacts?

Community visual qualities may be significantly impacted by large-scale developments such as PUD's, large subdivisions, multi-family housing, shopping centers, or industrial parks. Land use regulatory decisions such as commercial or multi-family rezonings may also strongly affect the visual environment through gradual, cumulative shaping of larger areas, even though individual developments within these areas may have little impact alone.

What are visual impacts? Common concerns are that a proposed development will displace man-made landmarks or unique natural features, damage views, or harm a community's overall image or attractiveness. Substantial alteration of the natural environment by removing trees or changing existing topography; nonconformity with existing built and natural contexts; visual obtrusiveness and scale disruption all affect community appearance. Thoughtful development can also bring about positive visual impacts by giving a new image to a community focal spot, or by reinforcing an existing positive image through respect for scale and sensitive signage or landscaping.

Developments which are very large, visually prominent, or very different from nearby areas may greatly affect the perception of the community by residents and outsiders. Such image changes are important in at least three ways. They affect how residents feel about the community. This in turn affects their future investments: how likely they are to improve and maintain their properties, how likely they are to move elsewhere. Finally, the community image influences outsiders who might come there to visit, to live, or to establish businesses.

Major new development can also alter a community's image to such an extent that the development comes to symbolize the community. Examples in Massachusetts include the Patriots' Stadium in Foxboro, recent apartment complexes in Framingham, the New Seabury development in Mashpee, Yankee Atomic in Rowe, and the University of Massachusetts at Amherst.

This chapter raises general process issues and also suggests broadly

applicable substantive categories by which to structure visual impact evaluation.

Recognition of the Issue

Citizen involvement and enthusiasm are readily mobilized around visual impact issues. One recent study of newspaper reports about rezonings which took place in the course of one year in the New York City, Washington, D.C., and San Francisco areas showed that visual concerns were raised far more frequently than any other issue in development reviews, twice as often as fiscal impacts and growth trends, the runners-up.[1]

Traditional zoning and subdivision regulations have strongly affected the visual environment though aesthetics have not, at least openly, been their primary aim. Recently, state legislatures and the courts have dealt explicitly with visual concerns. The newly adopted Zoning Act in Massachusetts, for example, allows towns to regulate land use for the purpose of developing their natural, scenic and aesthetic qualities.[2]

Increasingly, the courts are recognizing visual quality as a proper area of public concern and exercise of policy power. The weight given to visual considerations differs from state to state. In John Donnelly & Sons v. Outdoor Advertising Board[3] the Massachusetts Supreme Court held that "aesthetics alone may justify the exercise of the police power." The broad language of this opinion can be interpreted as a judicial affirmation of the visual environment's role in enhancing the public's general welfare. There are limits, however, to what a community may do. Regulation may not be arbitrary or capricious. It must be reasonably related to a legitimate public purpose and cannot be used as an obstructional device to limit or slow growth. It may not restrict an individual's use of his property so greatly as to constitute a taking. Clear standards must be established and due process afforded all parties. Controls must apply equally to similarly situated parcels.

---

[1] Philip S. Schaenman, Using an Impact Measurement System to Evaluate Land Development, Urban Institute, 1976, p. 17.

[2] Section 2A, Ch. 808, Acts of 1975, Massachusetts.

[3] 339 N.E. 2d 709.

The issue need not be whose tastes will be imposed upon whom. Subjective judgment will, of course, play a role as it does in the assessment of any of the impacts discussed in this manual. But visual concerns can be stated clearly and applied nonarbitrarily. They can focus on matters beyond taste, on such basic issues as legible signage, sunlight, and the preservation of important views.

STEPS IN VISUAL IMPACT ANALYSIS

The following steps can help structure the impact analysis process.

1. Formulate a Set of Impact Measures in the Form of a Checklist

The checklist, against which to review development proposals, will vary from community to community reflecting local goals and concerns. Its use helps assure consistency in impact evaluation from one project to the next. It can structure the process so that major impacts are not overlooked and most effort can be focussed on the selected important impact categories. An illustrative checklist is on page 145. The community may benefit by prearranging for technical assistance to formulate the checklist and to help later with periodic impact assessments (see Step 2).

2. Decide Who Will Do the Analysis

First, the community must obtain information on which to base a visual impact evaluation. If a specific development is proposed, its designer might be required to provide design information, graphic and written, as part of special permit, site plan review, or subdivision submission requirements for major proposals. He might be asked to document his consideration of selected issues of community concern by filling out sections of a prearranged impact checklist.

A town must then decide what level of technical assistance it wants in the detailed analysis and evaluation of important proposals. A design professional with experience in similar communities may provide insight into issues the community might otherwise overlook, can structure study efforts by others, suggest design modifications, and summarize findings and recommendations. On the other hand, if new to the scene, he might not fully understand the many nuances of residents' values and the visual qualities of

that community. Review by panels of laymen offers the benefits of community involvement and consensus building as well as intimate knowledge of the context. But their concern and experience may be limited to the immediate context. They may have an overly conservative tendency to preserve the status quo, or to settle for established, but mediocre, "good taste." Without clear standards, their findings may appear arbitrary. Sustaining such an effort also requires an enormous commitment of time and energy. Any combination of approaches may be appropriate.

3. Assess How Critical the Proposal's Site Is

a. Is the site visually prominent, seen by many people or from many directions? In some cases, development, even if large, may not be very visible because of its natural siting or location, its elevation, landscaping, and screening. It may therefore have minimal impact. Conversely, location can make even a small development highly prominent.

b. Is it near a landmark, man-made or natural? Will the landmark be overpowered or its visibility or access affected?

c. Is the location symbolically significant? For example, is it at a town's gateway? Does it have some special community significance?

d. Is the area one of clearly established design precedent, or is the visual quality largely ambiguous? Examples of places with established visual precedent are historic areas or sections of a town where, over time, every house has maintained similar fencing, landscaping or materials whose overall visual effect is highly valued and very sensitive to disruption.

4. Screen Proposals Against the Checklist

All major proposals, especially if they have been judged to lie on critical sites as defined in the third step, should be screened. A quick initial screening will usually isolate major impacts, if any, and many others will immediately drop out of consideration.

5. Analyze and Evaluate Major Impacts

Simulations in the form of scale models, eye-level sketches and photographs will be extremely useful if not essential for analysis. This information can often be provided by the developer as called for in Step 2. Impacts

should be described as explicitly as possible; if they can't be quantified, they should at least be ranked in importance with other impacts.

6. Identify Alternatives to Mitigate Negative Impacts

A development's features may be modified to lessen anticipated negative impacts. Thus a large parking lot might be landscaped and/or graded so that its elevation obscures its extent.

KEY ISSUES

Several issues that will emerge in carrying out the above steps are briefly addressed below.

The Checklist

-- Impact checklists, in the form of a list of "don'ts," often tend to mindlessly enshrine and promote the status quo. In a historic area, this approach might be entirely appropriate. On the whole, however, visual impact evaluation should not serve merely to avoid noxious development or just to insure its adequacy. Evaluation can form the basis for actively creating benefits and strengthening a sought-after image for a community. For example, a development's lighting should be assessed not only to see if it will cause glare, but also to see if its color might help produce a "special place" quality.

-- The choice of elements in the checklist must be tuned to the context of the community. The visual qualities which are most important vary from place to place; few are universally significant. In urban contexts, more emphasis might be given to the compatibility of structures with one another than in rural areas where more concern might be on the fit with nature. (Even here exceptions will abound.) Within rural areas, a hilly town with lakes might develop a checklist whose details differ from that of a wooded town with flat terrain.

-- During both the formulation of a checklist and the screening of proposals, citizen participation can be extremely useful in ensuring that a broad range of community values are reflected in impact analysis. Visual impacts often arouse controversy. What is of little concern to some population subgroups may impact others greatly.

Subject Scope

-- Though this manual's emphasis has been on the evaluation of private development's impacts, the visual impacts of public action on publicly owned land and roads should also be assessed. A new road alignment or plan for a public play lot can have great impact, both positive and negative.

-- Many people, when evaluating the visual impact of development, consider architectural "style" to be of foremost importance. In many cases style may not be the most productive element to assess. A much more basic impact on the visual environment usually results from siting relationships and the treatment of the landscape.

Data and Measurement

-- Visual impacts are often considered "soft" and very difficult to quantify. Descriptive, qualitative assessments are appropriate in many cases and may be stated explicitly, if not numerically. In some cases, quantitative measurements are possible, as in plotting cones of vision from important lookouts or counting the number of residents affected by blocked views.

-- Confidence in assessments may be increased by utilizing multiple measures of impact perception. Citizen survey results might be compared with impressions obtained in informal discussions, in public hearings, and from assessments of similar developments in neighboring communities.

-- Often, data by which to assess impact is vague or incomplete. One may, for example, be evaluating potential visual impacts of a proposed commercial rezoning without any design drawings of a specific proposal. Some visual impacts may be predictable regardless of the specific design. In other cases, the uncertainty of assessments should be acknowledged and ranges of possible outcomes estimated.

Analysis

-- The geographic scope of impact analysis must be explicit. An affected landmark or natural feature might be of more than local concern. A major edge of a development may face a neighboring municipality affecting its visual image and producing possible secondary impacts there on, for example, land values or traffic. Spillover effects like these should be considered.

-- Within the community itself, one should determine how different population subgroups perceive visual impacts. Different groups have different preferences for density, for the kinds of signs they would like to see, and have different concerns about privacy resulting from view impacts.

-- Secondary impacts must also be considered. Unattractive development might depress adjacent land values; if large, it might alter the image of the community held by outsiders, possibly affecting investment and employment opportunities. Visual secondary impacts may be important. Gas stations and strip development may follow upon the heels of a shopping center or large commercial rezoning.

-- Many visual impacts overlap and sometimes conflict with other impacts, such as traffic, social or natural environmental impacts. Widening roads for traffic safety might conflict with preserving rustic character; opening up views with privacy; increasing lot coverage with sewage requirements. More often than not, these conflicts can be resolved.

Sometimes, policies with visual aims have been couched solely in terms of the public health, safety, or morals. Thus, criticism of strip development and chaotic signage is expressed in terms of traffic congestion and hazard. Excessive road width is described in terms of aggravating storm runoff and water salinity. Since the legislatures and the courts increasingly recognize visual quality as a proper public concern, mutual aims should be openly stated, especially where they reinforce one another.

-- It is helpful to measure development impact against a general city or town visual policy in advance of major proposals and reflecting public consensus on the desired "look" of the place.

ILLUSTRATIVE VISUAL IMPACT CHECKLIST

Ten broad impact categories are discussed in this section together with examples. The checklist comprised of these elements is brief, incomplete, and only suggests how a community might start its own; the details would reflect the community's physical and social context, goals, and major types of expected development. Over time, new categories may be added, others deleted.

Impact analysis focuses initially on predicting and measuring changes in the visual environment caused by proposed development. Some changes will be more easily quantified than others. One next must assess the goodness or

badness of the changes. Whether the changes have been quantified or not, assessment of the benefit or harm that results demands judgment; changes may not necessarily be bad. Alternative design treatments to mitigate impacts that an analysis may deem harmful are also touched upon.

1. Visual Nuisances

Will a proposed development have elements widely judged to be eyesores?

Very few things are intrinsically ugly. It seems feasible, however, to select several items that are consistently judged to have strong negative impacts.

-- open dumps; garbage storage areas

-- buildings or objects in need of repair

-- litter

Some uses may generate relative large quantities of litter; fast-food stands, drive-ins, picnic grounds demand more litter cans and more frequent street cleaning than other places.

-- parking lots

Large asphalt surfaces can have a major negative impact. Impact may be reduced by moving the area out of sight behind buildings rather than in front, by limiting the allowed size of any one area, by landscaping, screening, selecting an alternative surface material if possible, and by creating a difference in elevation between the lot and adjacent land. Screening or landscaping is also easily applicable to dumps and storage structures.

2. Displacement

What elements of cultural, architectural, scientific, or natural significance will be lost or made less accessible? How important are they to whom?[1]

-- individual buildings of historic or architectural significance

-- historic or architectural districts

[1]Also consider what non-distinctive elements may be displaced by new development. For example, a new building may replace an unattractive parking lot or gas station.

-- individual unique natural features

-- scenic districts such as coastlines

Measures of importance might be based on such factors as historical significance, architectural quality, rarity, scholarly interest, tourist attraction, distance from a similar example, or community interest.

Cluster development or development rights transfer might be applied to preserve open space around landmarks.

3. Views

Will view opportunities and quality change? From where, of what, to whom?

Possible impacts:

-- blocked scenic views

-- elimination or access changes to public lookouts

-- changes in valued views from roads

Views may be preserved by changing the orientation of long, high buildings, by lowering height, or increasing side yards. New views and lookouts might be created by selective clearing of vegetation.

4. Light, Shade and Shadow

Will development change the distribution of natural and artificial light? If so, at what hours and in what seasons?

Natural

Development might:

-- cast shadows on open spaces including sidewalks affecting their use

-- affect vegetation which in turn alters light distribution

-- add or detract from needed shaded areas

Artificial

The nightscape can be dramatically impacted by artificial light, causing

-- glare

or potentially enlivening the spirit of place through choice of

---

[1]Also consider what non-distinctive elements may be displaced by new development. For example, a new building may replace an unattractive parking lot or gas station.

-- color

-- height and direction

As one example, street lighting along tree-lined roads can be given a warm hue and mounted low to accent foliage.

Provision of trees, arcades, overhangs and porches for the public all create shade if desired.

5. Visual Compatibility/Obtrusiveness With the Natural and Built Context

Will development preempt or overshadow natural features, or significantly change the scale or texture of the built environment?

Natural Context

Development might impact:

-- significant natural features

-- topography

-- landscaping

A project could compete in height and attention with a unique adjacent bluff, peak over the top of a forest silhouette, mar a critical shoreline or skyline, require major excavation on sloped sites, substantially remove existing trees, or alter the type of vegetation native to an area.

-- roads

Road width and alignment have strong visual impact; design can be related to the landscape type, wide roads with broad shoulders on open plains or narrow, curved, and gently rolling roads in wooded hills.

Built Context

Impacts include departures or consistencies in:

-- size: coverage and height

-- density

-- dimension of unbroken wall and roof areas; pitch angles

-- open space pattern

-- distance of buildings across roads; setbacks

-- proportions of openings: doors and windows

-- color, texture, material

Attention to the elements in this section will often allow contemporary design to successfully relate to even existing historic architecture. It

will thus be usually unnecessary and inappropriate to copy particular styles in order to respect historic areas.

6. Visual Interest Related to the Scale of Movement

Will development affect the streetscape as perceived by the pedestrian or auto traveler?

Pedestrian Movement

Possible impacts:

-- transparency

Increases in the visibility of activities behind building walls often enliven the street. As is true of all impact categories, judgment is required to assess whether change is good or bad. Transparency may not always be desired, as in the case of a Chinese restaurant whose interior may become a hidden retreat.

-- street wall continuity

The existing pattern comprises fences and planting, as well as building facades.

-- sidewalk dimension; setback

Is there room for sales, display or other activities to extend outdoors? Shelter, too, may be extended via overhangs and arcades.

-- spatial sequence

Does development disturb a special, well-established, and widely perceived succession of spatial experiences such as high/low, narrow/wide, or open/closed sequences? Does it create one?

-- floorscape/paving

-- entry frequency and condition

Is there, for example, an existing strong pattern of frequent, lighted entries; inset doorways; canopies; entries at half a level up from the street, or a half-level down? If there is no current pattern (or even if there is) should a new one be created?

-- small-scale detailing

Examples include ornamental ironwork, fences and planters designed with care.

Vehicular Movement

Impacts on streetscape perception by the motorist depend very much on his speed. Research in this area has only begun but a few general issues may be raised.

-- road edge definition

Roads in built-up areas often seem to spillover and merge with parking lots and even with sidewalks if driveways are frequent, yielding amorphous seas of asphalt. Road edge definition and sense of enclosure can be improved through close, regular spacing of sidewalk trees and utilities, reducing driveway frequency, encouraging street facade continuity, and careful design of edge elements such as berms, planting strips, curbing and fencing.

-- legibility of massing

The size and form of objects on theside of the road must be tuned to the motorist's speed, distance, and angle of approach, in order to be meaningful to him. Very "fussy," complex massing or detailing on a building or sign can be frustrating to a motorist if it is large enough to catch his eye, but too small to make sense out of.

7. Signage

Will signage communicate wanted information clearly and concisely?

-- private information

Does signage block views or cover up architectural features such as cornice and floor lines? Is it on or off premises? Often, signs can be clustered on fewer posts and clarity improved as well as attractiveness by using as few words as possible. Street trees reduce the apparent density of information and resultant chaos by screening distant signs from view.

-- public information

Similar issues apply to public signage. In addition, the public sector might add or manage new, wanted visual information such as time, weather, news, or transit arrivals. Public information kiosks and bulletin boards might be established.

8. Public Streetscape Utilities

Will details like litter cans, mailboxes, light poles, power lines, and other public utilities accompanying private development have significant visual impact?

Mailboxes are sometimes the most prominent furnishing of country roads. Selection of light stanchions, like the choice of lamp color, can respond to context; the standard aluminum poles found along highways need not be applied uniformly in every subdivision or rural road -- lighting mounted low on wooden stanchions or even integrated into a road parapet may be appropriate. Power lines also strongly impact the streetscape. If above ground, they may sometimes be positioned so that they are masked by trees, although excessive tree damage through reckless pruning often occurs in order to accommodate the lines.

9. Diversity

Does proposed development broaden the variety of visual experiences available to the community?

Not all shopping centers, industrial parks, or residential subdivisions need to be alike. People have widely divergent visual preferences. Visual opportunities may be expanded to satisfy such preferences not by serving up a chaotic menu of varied experiences, but rather by offering consistent, distinct environments that contrast with other environments.

10. Image

Will development change the overall image of the place? Will it be special, distinctive, legible, pleasantly memorable?

It seems appropriate to consider this category a summary impact measure because all the issues discussed thus far contribute to making or weakening a community's image. Discussion will focus on evaluating development impact on five image elements:[1]

-- paths

Will development disrupt well-trodden paths, make destinations less clearly accessible?

---

[1] Kevin Lynch, Image of the City, MIT Press, 1960.

-- edges

Some edges, like railroad tracks or major highways, act as barriers. Others, like a park strip between two housing developments, may act as seams. Some, like waterfronts, may be neither, but are important elements in our mental maps of places. Will proposed development become an edge? What kind and to what benefit?

-- districts

Will development affect the distinctiveness of an area of definable boundaries?

-- nodes

Will there be changes in major activity foci, such as public plazas, or main shopping street intersections? Will new activities concentrate or dilute existing activity centers?

-- landmarks

Issues of landmark displacement were discussed earlier. Will development create new landmarks?

Communities usually have an image they wish to present to the outside world. Siting major development on visually prominent sites can reinforce or weaken a desired image. A town, proud to be the new home of a regional high school, for example, and hoping it will grow into a regional hub of activity, might seek a highly visible and accessible location for the school.

GOING FURTHER

Active and Continuing Design Guidance

The impact review process outlined so far is a passive one: a community reacts, intermittently, to specific, major proposals and bases its decision to grant a rezoning or special permit approval for these projects at least partially on its analysis of visual impacts. Can a community do more?

Earlier, it was suggested that visual impact be evaluated with respect to an overall city or town visual policy formulated in advance of major proposals and reflecting consensus on the community's desired visual image. This section raises general issues of visual policy setting and implementation.

If an agreement on a general visual policy can be reached, tools can then be created to implement policy recommendations to preserve, enhance or foster selected visual qualities. These tools can include direct public action and expenditure, and the regulation of private development through new or amended zoning and subdivision provisions. Over a period of several decades, the cumulative impact of such traditional tools as lot coverage, setback, sideyard and parking requirements can be strikingly positive or negative. Thus, land use regulations, enforced on a continuing basis, can actively guide the design of new development whether it is small or large and regardless of whether it is subject to detailed impact review.

Setting Policy Goals

Examples of general visual policy statements might be: the distinctiveness of different parts of town should be heightened; visual departures from the status quo should be minimized; buildings should be freestanding objects; buildings should define the street edge with a continuous facade; and so forth. Whatever particular form they take, the process of forming visual goals might begin with the following actions:

-- Scenic resources such as landmarks, scenic districts and important views can be inventoried. Critical sites can also be mapped, such as those near existing landmarks, visually prominent, symbolically significant, or in areas of established design precedent.

-- Citizens might be asked to list or map what they perceive to be the community's visual assets and liabilities. What general areas, as well as specific sites, do many citizens value? What paths or journeys do they value?

-- Either lay citizens or professional staff might look to neighboring municipalities to find prototypes of different visual environments, some to be sought, some to be avoided.

-- Regulations affecting the visual environment can be inventoried. What is the currently allowable building coverage, texture and envelope for various uses and in different parts of town? What standards apply to roads, parking lots, yards, signs, etc.? Though regulations apply usually to individual parcels, it is important to assess their cumulative impact when multiplied over many parcels in a given area.

It may often be difficult at first to clearly and explicitly discuss visual goals solely with words. The use of slide analogues can be extremely helpful in rooting discussion about issues that are verbally elusive. Images of visual assets and liabilities, in town and elsewhere, can be photographed. Visual analogs considered potentially appropriate for a community can also be culled from newspapers and magazines. As visual goals begin to develop, they might be made more explicit through simple abstract diagrams or patterns. Key siting relationships that contribute to an overall visual image, but are otherwise hidden either in a slide or a descriptive paragraph, might be distilled out with the help of simple graphic diagrams. Talented professional assistance will be invaluable in these efforts.

The goal of these studies should not necessarily be to arrive at one all-encompassing visual image suitable for the entire community. Different parts of a municipality might appropriately have different images that new development can reinforce. Residential subdivision design in a hilly, wooded part of town might be quite different from that in a flat treeless district or on a visually prominent site.

Martha's Vineyard has such a visual policy. After careful analysis, the island has been mapped into eight landscape types. Development recommendations for density, siting, road character, color, and materials vary according to the landscape type and provide a concrete basis for examining compatibility of a development with its site.[1]

Developing Tools to Implement Policy Goals

A range of tools is available to the community.

Direct public action and expenditure. Far too often the level of design of public sector facilities is poor; outdoor recreational spaces, for example, frequently have an overabundance of chainlink fences. The selection of road width and alignment, street trees, lighting fixtures, and public signage can all be critically important. Public buildings such as post offices, police stations and libraries should be designed, landscaped, and maintained with at least as much care as might be expected of regulated private development.

---

[1] Vineyard Open Land Foundation, Looking at the Vineyard, West Tisbury, V.O.L.F., 1973.

Public infrastructure decisions, especially over sewers, water lines and roads, can have powerful secondary impacts on a community's growth pattern. Thoughtful location of capital improvements can promote density patterns that conform to design goals.

Private consensual agreements. Agreements on such matters as residential siting, materials, and color choice can be incorporated into private covenants running with the land. Sometimes, a design tradition is so strong that informal understandings among neighbors are all that is necessary to ensure compliance with that tradition.

For example, in Edgartown, Massachusetts, the visual context in higher density areas has a powerful fabric well recognized and seldom violated. People want to do things that help. How to do that is generally quite clear. Perhaps nothing more is needed.[1]

Regulation of private development. Traditional zoning and subdivision regulations, through the dimensional standards they impose over development as described earlier, are a powerful tool. Guidelines of the type used on Martha's Vineyard can be made part of these regulations, either in the form of detailed specifications, or as a basis for granting special permits in a framework offering more discretion to both decisionmakers and designers.

As seen in checklist, there is a formidable range of elements one might wish to control by regulation. One might structure efforts by procedding in three phases. The visual concerns in the earlier phase are somewhat more objective and specifiable than those in later phases which may be more judgmental in nature or subtle, and become progressively harder to achieve consensus over and to implement. The phases are described below.

1. One might attack first those issues that seem clearest, most objective and, perhaps, easiest to implement with conventional tools. Attention can focus on, for example, preventing bads: preventing glare, screening open dumps from view, or regulating the size, placement, and landscaping of parking lots. Conventional, key dimensional controls such as height can be considered here, as well as conventional devices to protect existing trees and control earth removal.

---

[1] See Charles Moore, Gerald Allen and Donlyn Lyndon, The Place of Houses, Holt, Rinehart & Winston, 1974.

2. The issues addressed in the second phase are specifiable, but may be more subjective than those in the first phase. Examples might include setback dimensions, road width and alignment, preferred colors (of both buildings and lighting) and materials, and other such siting considerations especially if they are a function of landscape type as in the policy on Martha's Vineyard. Other concerns appropriate to this stage might include selection of street furniture, treatment of fences, dimensions of unbroken wall and roof areas, levels of transparency, entry conditions, facade continuity, protection of important views and landmarks.

3. Only in the final phase should the subtlest and, perhaps, most disagreed upon values be dealt with. These might include the proportions of openings, detailing, and structuring spatial sequences. In very special contexts such as historic areas, style issues may emerge, or concerns about special features. Regulation over these matters demands great sensitivity and fairness.

In any phase, innovative tools may be applicable. Incentives, such as bonuses of land coverage or density, or tax assessment breaks might be offered to encourage visual amenities in selected places or to stimulate developers to go beyond minimum zoning or subdivision standards. A variety of design solutions and innovation can be fostered through the use of performance standards rather than precise dimensional specifications that often are arbitrary. Thus, the amount of daylight entering spaces might dictate building envelope and spacing, rather than detailed setback and sideyard standards.

An alternative to non-discretionary, self-administered visual guidance is the establishement of a design review panel, whether given formal powers or not. It seems very desirable that a degree of professional design skill be represented on such a panel. While lay judgment of visual impact is also important, sole reliance on it, without a prestated clear visual policy and without professional assistance, is of questionable value and fairness. Due process demands that review procedures and criteria be clear and that delays be minimized for developers. Visual consequences are seldom obvious, and there are few universally applicable "rules," other than that things hidden from view by topography or trees aren't likely to be offensive.

The appropriateness of design review depends on the details of the community's design concerns and its available skills and resources. Day-to-day

visual management might be self-administered, design review procedures being triggered only in special cases: if development exceeds a specified size threshold, if it is to be sited on a previously designated visually sensitive area, if it is precedent-setting or otherwise salient to the community by prestated criteria. A developer might voluntarily "back into" design review, seeking exceptions to strict standards by demonstrating that departures, in his specific case, would well serve visual policy objectives.

SUMMARY VISUAL IMPACT CHECKLIST

1. Visual Nuisances
   -- open dumps and garbage storage
   -- buildings and objects in disrepair
   -- litter
   -- parking lots

2. Displacement
   -- individual buildings
   -- historic or architectural districts
   -- unique natural features
   -- scenic areas

3. Views
   -- blocked scenic views
   -- lookouts
   -- views from roads

4. Light, Shade and Shadow

   NATURAL
   -- shadows cast
   -- vegetation impact
   -- shade provision

   ARTIFICIAL
   -- glare
   -- color
   -- height and direction

5. Visual Compatibility/Obtrusiveness

   NATURAL ENVIRONMENT
   -- significant natural features
   -- topography
   -- landscaping
   -- roads

   BUILT CONTEXT
   -- size: coverage and height
   -- density
   -- unbroken wall or roof dimension; pitch
   -- open space pattern
   -- distance across roads; setback
   -- proportion of openings
   -- color, texture, material

6. Visual Interest Related to Movement

   PEDESTRIAN
   -- transparency
   -- street wall continuity
   -- sidewalk dimension; setback
   -- spatial sequence
   -- floorscape/paving
   -- entry frequency and condition
   -- small-scale detailing

   VEHICULAR
   -- road edge definition
   -- legibility of massing

7. Signage
   -- private information
   -- public information

8. Public Streetscape Utilities

9. Diversity

10. Image
   -- paths
   -- edges
   -- districts
   -- nodes
   -- landmarks

CHAPTER 8

AFTER PREDICTION

When all the impact predictions are completed, presumably the raw ingredients for a well-informed decision will be at hand, but the emphasis should be on raw. Substantial future effort is necessary if the information is really going to affect the public decision, and if the public decision is really going to control the private outcome. Essentially, these next steps are:

1. Combine the predictions for each possible outcome into composite predictions for each decision alternative.

2. Consider whether the study was adequate. Were all key topics covered in adequate depth to provide a sound basis for decisions? Were the right alternatives studied, or should they be modified, or a wholly new set examined?

3. Clarify the comparison between alternatives through simplifications, highlighting, and formatting techniques.

4. Move to a decision, perhaps by further modifying one alternative so that it becomes the clear choice of everyone.

1. Combine Outcomes

Impacts of each of the outcomes of each decision alternative should be assembled for easy reference. A possible format is shown in Table 8-1. In this example, rezoning is judged to have three possible outcomes: apartments, single-family units, or vacant land. Similar tables would be made for the other public choices, such as not rezoning.

The consequendes of multiple outcomes stemming from a single decision can sometimes be summarized quantitatively. For example, in Table 8-1, if rezoning to District D is chosen, there is a 50% chance of development leading to a $2.00 tax rate reduction, a 25% chance of an $0.80 reduction, and a 25% chance of no tax rate impact. Overall, the "expected" tax rate change is the sum of the products of those probabilities and impacts:

$$0.50 \times \$2.00 + 0.25 \times \$0.80 + 0.25 \times 0.00 = \$1.20$$

TABLE 8-1
OUTCOME IMPACTS: REZONE TO DISTRICT "D"

	600 units multi-family	300 units single-family	Vacant Land	Overall assessment
Judged probability	50%	25%	25%	
Tax rate change ($/$1000)	- $2.00	- $0.80	0	- $1.20
Major street reconstruction?	Probably	Possibly	No	Maybe
Other traffic congestion?	Severe	Serious	None	Serious
Lost recreation use	Yes	Yes	No	Yes
Visual impact	Serious	Serious	None	Serious
Broadened housing choice	Yes	No	No	Maybe
Water quality threat	Yes	Yes	No	Yes

Other types of uncertainty can be handled in the same way. Results of alternative assumptions about, say, state fiscal formulas can be given probabilities and summed to yield a single number for each outcome.[1]

[1] Of course, something is lost in the use of that single number to replace a range of possible results. For example, in the following table, alternatives 1 and 2 are very different, with alternative 1 almost certain to be fiscally superior to alternative 2, despite having the same "expected value."

	TAX RATE REDUCTION Development Alternative 1	Development Alternative 2
If state tax system remains "A" (90% probability)	$3.00	$0.80
If state tax system becomes "B" (10% probability)	$4.00	$23.80
Expected value	$3.10	$3.10

2. Consider Study Adequacy

Quickly reviewing the impact predictions for all alternatives may reveal study inadequacies. It may have become clear that one or two impacts are really the keys to the decision, and that the quick techniques used for predictions don't provide enough confidence in results. Further professional study of those selected impacts may be warranted. It may have become clear that there are important impacts which weren't studied at all, and which should be added to the consideration.

It may have become clear that the alternatives studied are the wrong ones: none of them are acceptable, or better ones could now be designed given what has been learned. Maybe now it is understood that the right alternatives are not acquisition of parking area "a" versus "b" versus "c," but rather the broader question of acquisition of any parking area versus a shuttle bus (or the opposite: resolving the broader question brings up the narrower one of site choice).

For any of these reasons, it may be important to recycle through the prediction phase of the study. The need for such recycling happens often enough that whenever possible, the time schedule and budget (if any) for the impact analysis should allow for it.

3. Clarify Comparisons

If many impacts of a large number of alternatives have been looked at, simply arranging the results so they can be comprehended may not be easy. Table 8-2 shows a mixed verbal and quantitative approach. It reflects enormous simplification. Each tax rate change entry, for example, might reflect summing over several assumptions about future state fiscal structure and over a number of possible development outcomes. The one-word entries stand in place of paragraphs of description. However, that format does make possible considering all of the alternatives and all of their impacts at the same time.

Table 8-3 further simplifies and organizes the same predictions. First, it uses a graphic technique, which is easier to impressionistically scan than are words or figures. Second, it addresses the issue of who benefits and who pays by organizing the impacts into two subsets, based on which interest group is most concerned about them. Third, it moves from

TABLE 8-2
IMPACT SUMMARY: GOLF COURSE APARTMENTS

Impacts	City Decision Choices			
	Do Nothing	City Purchase	Rezone to D	Rezone to F
Tax rate change ($/$1,000)	+0.20	+0.20	-1.20	-1.40
Major street reconstruction?	No	No	Maybe	Yes
Other traffic congestion	Slight	None	Serious	Moderate
Lost recreation use	Doubtful	No	Yes	No
Visual impact	Small	None	Serious	?
Broadened housing choice	No	Unlikely	Maybe	Yes
Water quality threat	No	No	Yes	Some

TABLE 8-3
GRAPHIC IMPACT SUMMARY

Impacts	City Decision Choices			
	Do Nothing	City Purchase	Rezone to D	Rezone to F
CITY CONCERNS				
Tax rate change				
Lost recreation use				
Broadened housing choice				
Water quality threat				
NEIGHBORHOOD CONCERNS				
Street reconstruction				
Other congestion				
Visual impact				
Broadened housing choice				

 Clear, strong, positive impacts or no impact

 Neutral, or ambivalent, or uncertain

 Clear, strong, negative impact

prediction to evaluation: the prediction of broadened housing choice is evaluated and indicated as "positive" to the city as a whole, but "negative" to the neighborhood. This format makes the decision dilemma clear: that which apparently best serves the city (rezone to F with careful water quality controls) is different from that which apparently best serves the neighborhood (city purchase).

The summary of Table 8-3 suggests that the consideration can be further simplified: doing nothing or rezoning to D serve neither city nor neighborhood very well, so attention can focus on city purchase and rezoning to F. Loss of recreation use is a non-issue between those two. The water quality and negative visual impact threats following rezoning can be controlled. That leaves a greatly simplified set of considerations (see Table 8-4).

TABLE 8-4
REDUCED CONSIDERATIONS

	Alternatives	
	City Purchase	Rezone to F
CITY CONCERNS		
Tax rate change	$+0.20	$-1.40
Broadened housing choice	Unlikely. Only if city sells other golf course for subsidized housing.	Almost certain. Multi-family units, 10% subsidized.
NEIGHBORHOOD CONCERNS		
Street reconstruction	No traffic change, no major street reconstruction.	Kenrick level of service "F," widening virtually certain.
Other congestion	No change	Lake, Waverly, others drop 1 level of service.
Broadened housing choice	No threat here.	Major change in type of household in neighborhood.

4. Deciding

The outcome of an impact analysis is likeliest to affect decision-makers if it has a great feeling of reality for them. There are lots of ways of giving it that. Perhaps the most effective is involvement by the decision-makers in the analysis. If a comparable development is being used as an analog, it will be far more effective if decision-makers visit it, not just read a report on a visit to it by others. The traffic congestion analysis is based on local judgements about present level of service. It will be most believable if the decision-makers provided those judgements.

The decision may be easy. One alternative may be superior on all counts for all interests (though such finding merits verifying the objectivity of the analyst). There may be a mixed bag of good and bad impacts, but some impacts so catastrophic that those alternatives have to be eliminated, no matter how many good qualities they have.

It may be possible to winnow down to only two major impacts which differ among alternatives. Choice can then sometimes be clarified by simple arithmetic. In Table 8-5, scheme A clearly is the most productive in relation to amount of harbor fill, and schemes C and D are clearly inferior for either job enthusiasts or harbor savers. The remaining question is whether nearly tripling the amount of harbor fill in B versus A is justified by the 50% gain in jobs.

TABLE 8-5
PUBLIC PIER ALTERNATIVES

	Jobs Produced	Harbor area filled (s.y.)	Jobs per s.y. filled
Scheme A	220	55	4.0
Scheme B	340	140	2.4
Scheme C	260	140	1.9
Scheme D	180	56	3.2

Often, choices can't be resolved by such techniques. One alternative is best for one set of interests, another for another. There is a whole literature of how to then assign values to the outcomes and weights to the various affected interests and their preferences. The bibliography cites

such references. We are skeptical of their value, at least for the type of decisions being discussed here.

We do see merit in engaging broad public participation in the choosing. Citizen panels, for example, which earlier helped shape studies, should review the results. Panels might jointly make a recommendation on the proposal, by consensus among the groups or by voting. Other techniques take the form of "games" to facilitate group discussion, voting, and ranking of preferences. The bibliography lists sources of information about them. Community surveys can also be conducted. If carefully designed, they can elicit different groups' willingness to make tradeoffs of the type: "Is a $2.00 reduction on the tax rate worth a 50% traffic increase on Main Street?" More simply, open meetings can be held on preliminary findings.

Often, the key to being able to move ahead is modifying the alternatives so that one of them has something in it for everyone. Perhaps the rezoning to F displayed at Table 8-4 could be accompanied by a commitment to not close a neighborhood school, as had been planned. The alternative then becomes "Rezone to F, put special controls on water quality, require special height limits and design review with neighborhood participation, and keep the Mozart School open." Concensus is reached, a decision is made, and there is assurance that the outcome will have the desired qualities. That's what good impact analysis is all about: informing those making decisions so they can make them well, serving the interests of all who are affected.

SELECTED BIBLIOGRAPHY

The following sources may be useful for development impact analysis. Sources are organized by chapter of this guidebook; in addition, some references for environmental impacts are listed at the end. Items thought particularly useful are asterisked.

Other documents provide valuable background information specific to each city and town. These include:

a. Municipal reports: annual reports, Master Plans, public facility studies, etc.;

b. Regional Planning Agency studies;

c. State reports on each community: in Massachusetts, the Department of Commerce and Development has recently issued a new set of "profiles" for each city and town.

CHAPTER 1: PROCESS OF IMPACT ANALYSIS

Angotti, Thomas, Diane Joubert, Ann Preston, "Impact Analysis: Science or Art?", Massachusetts Department of Community Affairs, Office of Municipal Planning and Management, 1975.

Crouch, R.L. and R.E. Weintraub, "Cost-Benefit Analysis of a PUD," Urban Land, June 1973.

Gruen, Gruen and Associates, The Impacts of Growth, An Analytical Framework and Fiscal Example, San Francisco: California Better Housing Foundation, 1972.

*Schaenman, Philip, Using an Impact Measurement System to Evaluate Land Development, Washington, D.C.: Urban Institute, 1976. One of the best single works on impact analysis. Suggests general study approaches. Available for $3.95 from the Publications Office, The Urban Institute, 2100 M Street N.W., Washington, D.C. 20037 (refer to publication "URI 15500").

*Schaenman, Philip and Thomas Muller, Measuring Impacts of Land Development, Washington, D.C.: Urban Institute, 1974. Useful for all chapters in this guidebook, suggesting specific impact measures and general study approaches; discussion of study approaches has been superceded by P. Schaenman, Using an Impact Measurement System..., op.cit. Available for $2.95 from the Publications Office, The Urban Institute, 2100 M Street N.W., Washington, D.C. 20037 (refer to publication "URI 86000").

Quantitative Decision Methods

For those who find them useful, the following technical references suggest quantitative methods for weighting impacts and considering their timing and uncertainty.

Dacy, Douglas, Robert Keumne, and Martin McGuire, Approaches to the Treatment of Incommensurable in Cost-Benefit Analysis, prepared for the National Science Foundation by the Institute for Defense Analysis, Program Analysis Division, Arlington, Virginia, 1973.

Eckstein, Otto, Water-Resources Development: The Economics of Project Development, Cambridge: Harvard University Press, 1958. The classic on cost-benefit analysis.

Friend, J.K. and W.N. Jessop, Local Government and Strategic Choice, London: Tavistock Publications, 1969. Pages 177-193 illustrate a method for weighting preferences of diverse interest groups.

Hinrichs, Harley and Grame Taylor (eds.), Program Budgeting and Benefit-Cost Analysis, Pacific Palisades, Calif.: Goodyear, 1969.

Raiffa, Howard, Decision Analysis, Introductory Lectures on Choices Under Uncertainty, Reading, Mass.: Addison-Wesley, 1968.

Schermer, Julie Hetrick, "Interest Group Assessment in Transportation Planning," Traffic Quarterly, January 1975.

U.S. Army, Office of the Chief of Engineers, Water Resources Assessment Methodology (WRAM) -- Impact Assessment and Alternative Evaluation, Environmental Effects Laboratory, February 1977. Quantitative scaling and weighting techniques.

Van Horne, James, Financial Management and Policy, Englewood Cliffs: N.J.: Prentice-Hall, 1972. See discussion on present value analysis.

Citizen Participation Techniques

Dean Runyan, "Tools for Community-Managed Impact Assessment," Journal of the American Institute of Planners, April 1977. Summary of community-level group involvement in impact assessment, emphasizing social impacts.

*Halprin, Lawrence and Jim Burns, Taking Part: A Workshop Approach to Collective Creativity, Cambridge: MIT Press, 1974. Contains innovative approaches to engaging participation.

Delbecq, Andre and Andrew Van de Ven, "A Group Process Model for Identification and Program Planning," Journal of Applied Behavioral Science 7, Jan./Feb. 1971, p. 466. A group process and voting technique.

Duke, Richard and Cathy Greenblat, IMPASSE, Ann Arbor, Mich." Radius International, 1973. A simple group impact assessment game that structures discussion and provides estimates of impacts for one or more proposals.

Linstone, H. and M. Turoff, The Delphi Method: Technique and Applications, Reading, Mass.: Addison-Wesley, 1975. A method to elicit opinions of a group of individuals without meetings or direct discussion.

CHAPTER 2: TRAFFIC IMPACTS

Traffic Generation Data

Abend, Norman, "Traffic Generation of Residential Land Use," memo for Massachusetts Department of Community Affairs, 28 September 1973.

Buttke, Carl, "An Approximation of Regional Shopping Center Traffic," Traffic Engineering, April 1972.

Edwards & Kelcey, Central Corridor Traffic Study, for Massachusetts Department of Public Works, Boston, 1965.

Hansen, Dennis, Volume XV Travel Generation, National Association of County Engineers Action Guide Series, Washington, D.C.: National Association of Counties Research Foundation, July 1972. Suggests approaches and issues for traffic studies; summarizes national traffic generation data. Available free from Planning Procedures Branch HHP24, Federal Highway Administration, Washington, D.C. 20590.

Herr Associates, "Performance Zoning II," for Franklin County Planning Department and Massachusetts Department of Community Affairs, June 1972. See Traffic/Lot Size Analysis.

Institute of Traffic Engineers, Committee 5N-S, "Guidelines for Driveway Design and Location," Traffic Engineering, February, March and April, 1973. Summarizes national traffic generation data and suggests how to estimate traffic from a proposal.

Institute of Traffic Engineers, Ohio Section, "Trip Generation Study Provides Useful Preliminary Data," Traffic Engineering, March 1974.

Institute of Transportation Engineers, Trip Generation, ITE Informational Report, 1976.

Keefer, Louis and David Witheford, Urban Travel Patterns for Airports, Shopping Centers and Industrial Plants, Washington, D.C.: Highway Research Board, National Academy of Sciences--National Research Council, 1966.

*Maricopa Association of Governments, Trip Generation by Land Use, Part I: A Summary of Studies Conducted, Maricopa Co., Arizona, April 1974. The most useful summary of traffic generation studies from around the country. Limited number of copies available free from Planning Procedures Branch HHP24, Federal Highway Administration, Washington, D.C. 20590.

Martha's Vineyard Commission, "Table of Regional Traffic Generators," Oak Bluffs, Mass.: M.V.C., October 1975.

Shaw, Robert, "Traffic Generation and Fast Food Restaurants," Traffic Engineering, March 1975.

Smith, Wilbur and Assoc., Patterns of Car Ownership, Trip Generation and Trip Sharing in Urbanized Areas, New Haven, 1968.

Other Traffic References

Highway Research Board, Highway Capacity Manual 1965, Special Report 87, Washington, D.C.: National Academy of Sciences--National Research Council, 1966. Technical method for estimating capacity and level of service.

Institute of Traffic Engineers, Technical Committee 5DD, "Guidelines for Planning and Designing Access Systems for Shopping Centers," Traffic Engineering, January and February, 1975.

Institute of Traffic Engineers, Traffic Engineering Handbook, rev.ed. August 1975.

Lynch, Kevin, Site Planning, Cambridge: MIT Press, 1971, pp. 118-156.

Massachusetts Department of Public Works, "1974 Traffic Volumes" (updated periodically). Data mainly for state highways.

Urban Land Institute, American Society of Civil Engineers and National Association of Home Builders, "Residential Streets: Objectives, Principles and Design Considerations," 1974.

CHAPTER 3: PUBLIC FACILITY IMPACTS

General References

DeChiara, Joseph and Lee Koppelman, Manual of Housing, Planning and Design Criteria, Englewood Cliffs, N.J.: Prentice-Hall, 1972.

Goodman, William and Eric Freund, Principles and Practices of Urban Planning, Washington, D.C.: International City Managers Association, 4th edition, 1968, Chapter 8.

Lynch, Kevin, Site Planning, Cambridge, Mass.: MIT Press, 1971.

Real Estate Research Corporation, The Costs of Sprawl, Washington, D.C.: U.S. Council on Environmental Quality, 1974. Includes extensive bibliography.

U.S. Department of Health, Education and Welfare, Public Health Service, Environmental Health Guide, Washington, D.C., 1962.

Schools

Herr Associates, "School Facilities Plan," prepared for Clinton Planning Board and Massachusetts Dept. of Community Affairs, 18 March 1971. Method for school construction planning based on alternative assumptions about future enrollments.

Massachusetts Department of Education, Bureau of Research and Assessment, "Enrollment Projections for Public Schools in Massachusetts, 1975-1979," October 1975.

Recreation

Massachusetts Department of Environmental Management, "Massachusetts Outdoors -- Statewide Comprehensive Outdoor Recreation Plan," December 1976. Discusses state and regional demand for various recreational activities, and capacity standards for facilities.

National Recreation and Park Association, "Outdoor Recreation Space Standards," New York, 1965.

Water

Bond, Richard and Conrad Straub (eds.), CRC Handbook of Environmental Controls, Volume III: Water Supply and Treatment, Cleveland: CRC Press, 1972. Collection of tables from various water studies.

Insurance Services Office, "Guide for Determination of Required Fire Flow," New York; I.S.O., 1974.

Linaweaver, F.P., John Geyer and Jerome Wolff, "A Study of Residential Water Use," for U.S. Federal Housing Administration, Washington, D.C., 1967. Careful nationwide study.

Massachusetts Department of Public Health, Annual Water Consumption by Municipality (unpublished).

Metcalf & Eddy, Wastewater Engineering: Collection, Treatment, Disposal, New York: McGraw-Hill, 1972.

New England River Basins Commission, How to Guide Growth in Southeastern New England, Boston: N.E.R.B.C., May 1975.

Strahler, Arthur N., The Environmental Impact of Ground Water Use on Cape Cod, Orleans, Mass.: Association for the Preservation of Cape Cod, 1972. Clear explanation of how ground water sources can be polluted by development.

Sewage

Massachusetts Department of Public Health, State Sanitary Code, Article XI, Minimum Requirements for the Disposal of Sanitary Sewage in Unsewered Areas, 1966. Currently being revised.

Massachusetts Federation of Planning Boards, Planners Handbook, Braintree, Mass.: M.F.P.B., revised 1975. See Appendix S: "Guide for Lot Size Determination for Single-Family Dwellings."

Metcalf & Eddy, Wastewater Engineering: Collection, Treatment, Disposal, New York: McGraw-Hill, 1972.

Tabors, Richard, Peter Rogers and Michael Shapiro, Land Use and the Pipe: The Impact of Sewer Extension on Land Use, Lexington, Mass.: Lexington Books, D.C. Heath & Co., 1976. Discusses related issue of how sewers spur further development.

Storm Drainage

Urban Land Institute, American Society of Civil Engineers and National Association of Home Builders, "Residential Storm Water Management: Objectives, Principles, and Design Considerations," 1975. Valuable discussion emphasizing on-site storage and site design rather than major public systems. Available for $7.50 (non-members) from the Urban Land Institute, 1200 18th Street N.W., Washington, D.C. 20036.

U.S. Environmental Protection Agency, Office of Research and Monitoring, Stream Quality Preservation through Planned Urban Development, Washington, D.C., 1973. Effect of development on stream flooding.

Solid Waste

Bond, Richard and Conrad Straub (eds.), CRC Handbook of Environmental Control, Volume II, Solid Waste, Cleveland: CRC Press, 1972. Collection of tables from various solid waste generation studies.

Raytheon Service Co., Solid Waste Management Study Report, for the Massachusetts Department of Public Works, 1972. Extensive, three-volume statewide study of solid waste generation and alternative disposal methods.

Other Facilities

American Library Association, Public Library Association, "Interim Standards for Small Public Libraries: Guidelines Towards Achieving Goals of Public Library Service," Chicago, 1962.

CHAPTER 4: FISCAL IMPACTS

General Methods

Angotti, Thomas, Diane Joubert and Anne Preston, "Impact Analysis: Science or Art?", Massachusetts Department of Community Affairs, Office of Municipal Planning and Management, 1975.

Connecticut Development Group, Inc., Cost Revenue Impact Analysis for Residential Developments, Washington, D.C.: U.S. Department of Housing and Urban Development, 1974.

Devanney, J.W., G. Ashe and B. Parkhurst, Parable Beach: A Primer in Coastal Zone Economics, Report to Office of Coastal Zone Management, U.S. Department of Commerce, Cambridge, Mass.: MIT, November 1974.

Mace, Ruth, Municipal Cost-Revenue Research in the United States, A Critical Survey of Research to Measure Municipal Costs and Revenues in Relation to Land Uses and Areas: 1933-1960, Chapel Hill, N.C.: Institute of Government, University of North Carolina, 1961.

*Muller, Thomas, Fiscal Impacts of Land Development, A Critique of Methods and Review of Issues, Washington, D.C.: Urban Institute, 1975. Useful recent discussion of methods and issues. Available for $2.95 from Publications Office, The Urban Institute, 2100 M Street N.W., Washington, D.C. 20037 (refer to publication as "URI 98000").

Case Studies

Adams, Howard and Opperman, "Comprehensive Development Plan, Town of Lincoln," 1965.

Boston Municipal Research Bureau and ABT Associates, The Effect of High Density Development on Municipal Finances in the City of Boston, Boston, April 1974. Detailed comparison of several residential and non-residential sections of Boston.

Gruen, Gruen and Associates, The Impacts of Growth, An Analytical Framework and Fiscal Example, San Francisco: California Better Housing Foundation, 1972.

Houston, Susan Levine, "The Costs and Revenues Generated by Low and Moderate Income Housing in the Suburbs: A Study of Newton," unpublished Master of City Planning Thesis, MIT, 1972. Item-by-item analysis of service costs.

Levin, Michael, "Cost-Revenue Impact Analysis: State of the Art," Urban Land, June 1975.

Mace, Ruth and Warren Wicker, "Do Single-Family Homes Pay Their Way?", Washington, D.C.: Urban Land Institute (research monograph 15), 1968.

Minuto, James, Cost-Revenue Study, Community Development Department, Cambridge, Mass., March 1976.

Muller, Thomas and Grace Dawson, Fiscal Impact of Residential and Commercial Development, Washington, D.C.: Urban Institute, 1972.

Stephens, George, "Fiscal Impact Model for Land Development: A Case Study," Urban Land, June 1975.

Stuart, Darwin and Robert Teska, "Who Pays for What?", Urban Land, March 1971.

Background Data

Boston Safe Deposit and Trust Company, "Financial Statistics of Massachusetts, Including State, Counties, Cities, Towns, Districts and Authorities" (annual). Shows debt, debt ratios, etc.

Massachusetts Department of Community Affairs, State Building Code Commission, "Number and Value of Building Permits" (monthly). For estimating current number of dwellings in community.

Massachusetts Department of Corporations and Taxation, Bureau of Local Assessment, Assessed and Equalized Valuations by Land Use for Each City and Town (unpublished).

Massachusetts Department of Corporations and Taxation, Bureau of Planning and Research, Amount of Chapter 70 School Aid and Other State Aid to Each City and Town (from each year's "Cherry Sheet")(unpublished).

Massachusetts Department of Education, Research, Planning and Evaluation Division, "Analysis of School Aid to Massachusetts Cities and Towns Chapter 70 Amended" (annual). Shows Ch. 70 school aid percentage for each community.

*Massachusetts Taxpayers Foundation, "Municipal Financial Data, Including 1976 Tax Rates" (annual). Lists current tax rates, levies, assessments for each community. Available free from Massachusetts Taxpayers Foundation, 1 Federal Street, Boston, Mass. 02110.

Sternlieb, George and Robert Burchell, "The Numbers Game: Forecasting Household Size," Urban Land, January 1974. Estimates school children by type of unit and number of bedrooms based on extensive New Jersey survey.

U.S. Bureau of the Census, Census of Housing: 1970, Vol. 1, Housing Characteristics for States, Cities and Counties; Part 23, Massachusetts, Washington, D.C.: U.S. Government Printing Office, 1972. Indicates number of dwellings in each community in 1970.

Potential Changes in Massachusetts Fiscal Structure

Eisenmenger, Robert, Alicia Munnell and Joan Poskanzer, Options for Fiscal Structure Reform in Massachusetts, Federal Reserve Bank of Boston Research Report 57, March 1975. Describes current fiscal system and possible changes.

Herr Associates, "Revenue Analysis" for Ashland Finance Committee, rev. 11 December 1972. Analyzes local tax impacts of development under different assumptions about the future of the state fiscal system.

CHAPTER 5: ECONOMIC IMPACTS

Employment Impacts

Boston Economic Development and Industrial Commission, "Boston's Industry," 1970. Survey of existing Boston manufacturers, including square feet per employee.

Boston Redevelopment Authority, "Jobs for Boston's Future -- Expanding the City's Economic Base Through Capital Investment -- Mayor Kevin White's Program," November 1975. Estimates of construction and permanent jobs in potential development.

Devanney, J.W., G. Ashe, and B. Parkhurst, Parable Beach: A Primer in Coastal Zone Economics, Report to Office of Coastal Zone Management, U.S. Dept. of Commerce, Cambridge, Mass.: MIT, November 1974.

Building Construction Cost Data 1976, Duxbury, Mass.: Robert Snow Means Co., 1975. Construction costs per square foot.

Hyun, David Kyun (ed.), Preliminary Cost Guide, Complete System for Total Project Development, Pasadena, Calif.: Architectural Data Corporation, 1974. Construction costs per square foot.

*Massachusetts Division of Employment Security, "Employment and Wages in Establishments Subject to the Massachusetts Employment Security Tax," (annual). Number of employees who work in each city and town.

*Muller, Thomas, Economic Impacts of Land Development, Washington, D.C.: Urban Institute, 1976. Good discussion of impact measures for employment, housing, and property values. Available for $3.95 from Publications Office, The Urban Institute, 2100 M Street N.W., Washington, D.C. 20037 (refer to publication as "URI 15800").

Massachusetts Division of Employment Security, Estimates of Labor Force and Unemployment Rates for Each City and Town (unpublished; compiled monthly).

Massachusetts Division of Employment Security, "Massachusetts Trends in Labor Force, Employment, Unemployment" (monthly). Data for labor market areas not for individual communities.

Massachusetts Office of State Planning, 1970 U.S. Census data on jobs, labor force, and commuting for each city and town (unpublished).

1976 Dodge Construction System Costs, New York: McGraw-Hill Information Systems Co., 1975. Construction costs per square foot.

U.S. Bureau of the Census, Census of Population: 1970, Detailed Characteristics, Final Report PC(1)-D23 Massachusetts, Washington, D.C.: U.S. Government Printing Office, 1972. Type of jobs by industry, etc.

U.S. Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics, Final Report PC(1)-C23 Massachusetts, Washington, D.C.: U.S. Government Printing Office, 1972. Data on occupations, income, journey to work, etc., by community.

Business Opportunities

Department of Hotel, Restaurant and Travel Administration, University of Massachusetts at Amherst, The Economic Impact of Tourism on the Commonwealth of Massachusetts, for the Massachusetts Department of Commerce and Development, December 1974. Provides "multipliers" for estimating indirect effects of a new activity on the state economy; see pp. 65-83, 149-161. Quite technical.

Hellman, Daryl, "External Impacts of Housing Developments: Calculating Effects on Commercial Property Values," Urban Land, October 1974. Elaborate method for projecting retail sales due to new residents.

Herr Associates, "Retailing in Andover," prepared for Andover Planning Board, 3 July 1975. Projects local retail sales due to residential growth.

Massachusetts Department of Commerce and Development, Industrial Directory of Massachusetts Manufacturers, 1974-1975 edition. Lists current manufacturers in each city and town, suggesting potential suppliers (if any) for new firms.

Urban Land Institute, Dollars and Cents of Shopping Centers, Washington, D.C.: U.L.I., 1975. Lists sales per square foot by type of store.

U.S. Bureau of the Census, Census of Retail Trade, 1972, Area Series, Massachusetts, RC72-A-22, Washington, D.C.: U.S. Government Printing Office, 1974.

Other Economic Issues

Blumenfeld, Hans, "The Economic Base of the Metropolis, Critical Remarks on the Basic-Nonbasic Concept," Journal of the American Institute of Planners, 1955.

Harrison, Bennett, Economic Development for Massachusetts, for Joint Committee on Commerce and Labor of the Massachusetts Legislature, 1974. Challenges many common assumptions about state economic needs and development approaches.

Sweet, David, "The Systematic Approach to Industrial Development Research," Urban Land, June 1970.

Ullman, Edward, Michael Dacey, Harold Brodsky, The Economic Base of American Cities, Seattle: University of Washington, Center for Urban & Regional Research, rev. 1971. Survey, mainly for larger cities.

CHAPTER 6: SOCIAL IMPACTS

Population

Gans, Herbert, "The Balanced Community: Homogeneity or Heterogeneity in Residential Areas," Journal of the American Institute of Planners, August 1961. Classic article on advantages and disadvantages of a diverse population living in a community.

Massachusetts Secretary of the Commonwealth, 1975 State Census.

U.S. Bureau of the Census, Census of Housing: 1970, Components of Inventory Change, Final Report HC(4)-3, Boston, Mass. SMSA, Washington, D.C.: U.S. Government Printing Office, 1973. Characteristics of occupants in new and older units in the Boston metropolitan area.

U.S. Bureau of the Census, Census of Population: 1970, General Population Characteristics, Final Report PC(1)-B23, Massachusetts, Washington, D.C.: U.S. Government Printing Office, 1971.

U.S. Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics, Final Report PC(1)-C23, Massachusetts, Washington, D.C.: U.S. Government Printing Office, 1972. Incomes, occupations, many other characteristics

Housing

Dorchester-Columbia Point Task Force (with assistance of Justin Gray Associates), "Report on the Impact of U.Mass. in Dorchester," Boston, January 1973. Case study, emphasizes housing impacts in surrounding neighborhood.

Massachusetts Department of Community Affairs, 1974 Report on Housing Needs and Programs. Table 7 shows housing needs estimates for each city and town (based on 1970 U.S. Census).

U.S. Bureau of the Census, Census of Housing: 1970, Vol. 1, Housing Characteristics for States, Cities and Counties, Part 23, Massachusetts, Washington, D.C.: U.S. Government Printing Office, 1972.

U.S. Department of Housing and Urban Development, FHA Economic and Market Analysis Division, FHA Techniques of Housing Market Analysis, Washington, D.C.: HUD, rev. 1970.

Other Social Impacts

Christensen, Kathleen, Social Impacts of Land Development, Washington, D.C.: Urban Institute, 1976. Provides illustrative citizen survey form and discusses impacts on recreation patterns, shopping opportunities, pedestrian mobility, and safety and privacy. Available for $3.95 from Publications Office, The Urban Institute, 2100 M Street N.W., Washington, D.C. 20037 (refer to publication as "URI 15700").

Duncan & Jones, Methodology and Guidelines for Assessing Social Impacts of Development, Berkeley, CA: July 1976. Good outline of assessment process.

Keller, Suzanne, The Urban Neighborhood: A Sociological Perspective, New York: Random House, 1968. Discussion of sociability in residential neighborhoods.

Massachusetts League of Cities and Towns, "1975-1976 Massachusetts Municipal Directory," Boston: MLCT, 1975. Lists government structure for each city and town.

New Jersey County and Municipal Government Study Commission, Housing & Suburbs: Fiscal and Social Impact of Multi-Family Development, Trenton, October 1974. Comprehensive discussion of social impacts and community attitudes toward apartments.

Proshansky, Harold, W. Ittelson and L. Rivlin (eds.), Environmental Psychology: Man and His Physical Setting, New York: Holt, Rinehart & Winston, 1970. General reader on psychic and social effects of one's environment.

"Report of the Apartment Impact Study Committee," for the Burlington, Mass. Planning Board, 15 March 1973. Includes survey of residents' attitudes toward recent apartment developments.

Stanford Research Institute, City Size and the Quality of Life, for National Science Foundation, Washington, D.C.: U.S. Government Printing Office, 1974. National comparisons, mainly of larger cities.

CHAPTER 7: VISUAL IMPACTS

Lynch, Kevin, Site Planning, Cambridge, Mass.: MIT Press, 1971.

*Lynch, Kevin, Managing the Sense of a Region, Cambridge, Mass.: MIT Press, 1976. Good survey of evaluation techniques and management tools.

Nally, Thomas, Design Review: Alternative Models of Administration, unpublished Master in City Planning Thesis, MIT, 1977. Thorough analysis of effectiveness of different review mechanisms in different contexts.

Skidmore, Owings & Merrill, Physical Impacts Notebook, prepared for the U.S. Dept. of Transportation, Washington, D.C., 1975. Focuses on impacts of transportation facilities but useful general reference.

Vineyard Open Land Foundation, Looking at the Vineyard: A Visual Study for a Changing Island, West Tisbury, Mass.: VOLF, 1973. Example of general visual guidelines for new development.

SOURCES FOR ENVIRONMENTAL IMPACTS

Burchell, Robert and David Listokin, The Environmental Impact Handbook, New Brunswick, N.J.: Rutgers University, Center for Urban Policy Research, 1975.

California Council of Civil Engineers and Land Surveyors, Environmental Impact Analysis, Sacramento, 1972.

Herman, Barbara, "Environmental Review Team," AIP Planners Notebook, February 1975.

Illinois Institute for Environmental Quality, Environmental Impact Statements: A Handbook for Writers and Reviewers, Urbana-Champagne, Ill.: Univ. of Illinois, August 1973 (distributed by National Technical Information Service, U.S. Dept. of Commerce, Washington, D.C.).

*Keyes, Dale L., Land Development and the Natural Environment: Estimating Impacts, Washington, D.C.: Urban Institute, 1976. Available for $4.95 from Publications Office, The Urban Institute, 2100 M Street N.W., Washington, D.C. 20037 (refer to publication "URI 13500").

Leopold, Luna et al., A Procedure for Evaluating Environmental Impact, Washington, D.C.: U.S. Geological Survey, 1971.

Massachusetts Executive Office of Environmental Affairs, "Environmental Assessment Form Manual," December 1975. Instructions for filling out state environmental assessment forms.

Massachusetts Executive Office of Environmental Affairs, "Regulations Governing the Preparation of Environmental Impact Reports," 6 October 1975.

Skidmore, Owings & Merrill, Physical Impacts Notebook, prepared for the U.S. Department of Transportation, Washington, D.C., 1975. Focuses on impacts of transportation facilities but useful general reference.

U.S. Council on Environmental Quality, "Preparation of Environmental Impact Statements: Guidelines," Federal Register, 1 August 1973.